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FURTHER NOTES ON *RHINOCYPHA* LARVÆ

BY

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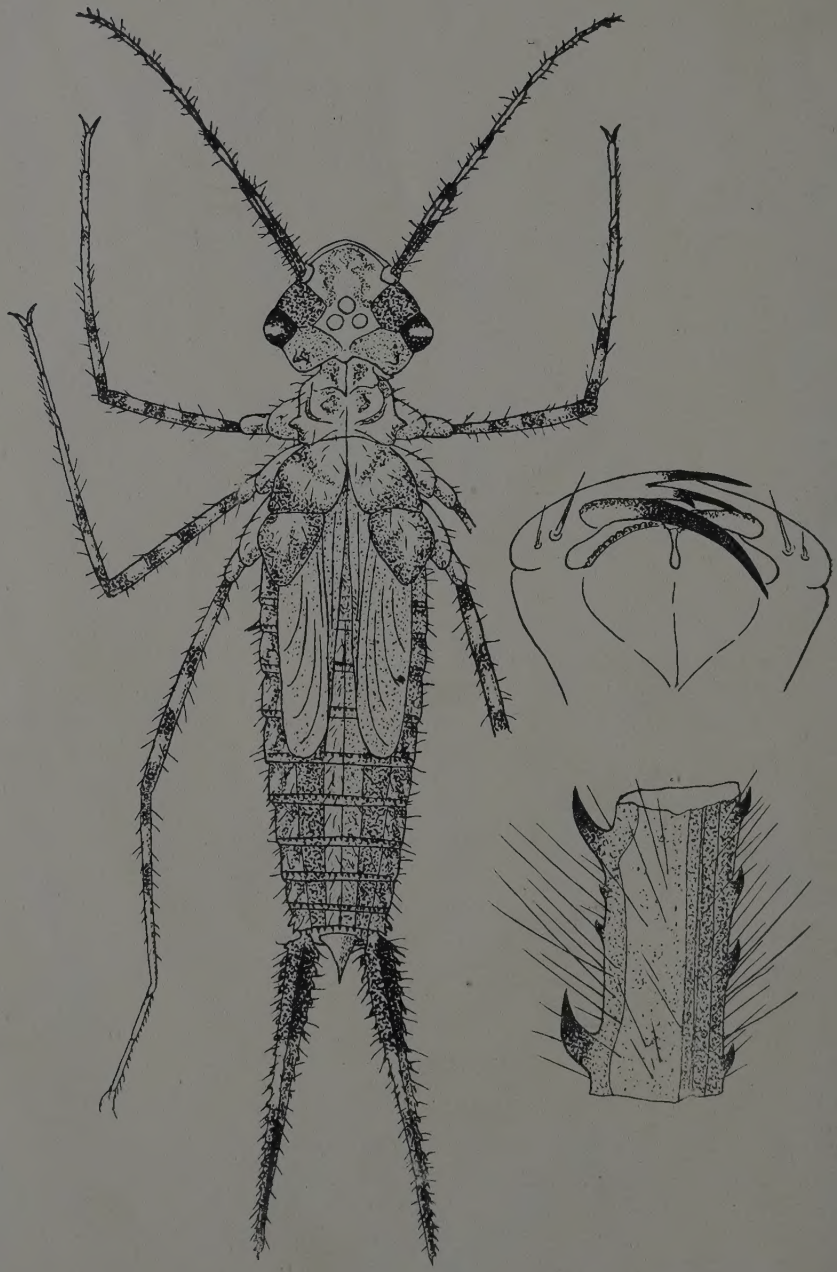


ADULT LARVA OF *RHINOCYPHA IGNIPENNIS*.

FURTHER NOTES ON *RHINOCYPHA* LARVÆ.

BY

MAJOR F. C. FRASER, I.M.S.

[Received for publication on 3rd December 1921.]

THE ADULT LARVA OF *Rhinocypha ignipennis* (Plate IX).

IN the Memoirs of Pusa, Entomological Series, Vol. VII, No. 2, June 1920, I described the young larva of a *Rhinocypha* which Mr. Bainbrigge Fletcher showed was that of *R. ignipennis*. Several adult larvæ have since been taken by the same collector so that I am now able to add to the previous description and to correct the wrong impression I had formed that these larvæ do not possess caudal gills.

Caudal gills are certainly absent in the first two instars as in the majority of Zygopterous larvæ, breathing being purely rectal or taking place through the thin cuticle, the gills being either undeveloped, hairy or filamentous. In the young larvæ of *ignipennis* they are certainly absent or the autotomy must be extraordinarily neat.

If a comparison be made between the young and adult instars, great changes will be noted, the legs for instance, which are enormously out of proportion to begin with, fail to keep pace with the growth of the trunk and eventually compare well with the length of the body.

There are some smaller but important changes in the mask which flattens and lengthens, the middle lobe becoming fairly deeply cleft.

The caudal gills develop, closely paralleling those of *Micromerus*, and the usual changes associated with the development of the wing sheaths take place in the thorax.

The whole appearance of the larva is strikingly like that of *Micromerus* and differs only in detail. The plate given here of *R. ignipennis* should be compared with that given for *Micromerus lineatus* in the *Records of the Indian Museum*, Vol. XVI, Part 11, No. 9, 1918.

The antennæ are sparsely hirsute, the pedicel is strongly ribbed longitudinally, pigmented at its apex and the basal half, the second joint is also pigmented apically.

The eyes are small, projecting laterally and are deeply pigmented with blackish brown, this colour also covering a contiguous area of the epicranium which gives a false idea of the size of the eyes.

The frons is mottled with a serpiginous pattern of brown. On the occiput are found two prominent, dorsal spines, situated on the postocular lobe and nearer the middle line than in *Micromerus*, and its posterior border is deeply concave. On the synthorax there are two dorsal spines situated near the middle of the pronotum and also two lateral ones. The mesopleura are more square and the metapleura rounder than in *Micromerus*. The legs are very similar to those of the same insect, but the distal pigmented band on the femur is darker and there are apical and subapical bands on the tibiæ as well. The caudal gills are armed with more robust spines and the basal third and apical half are deeply pigmented in some specimens or only in the basal half of others. The armature varies, the spines being closely or widely set and the number varying. The *appendix dorsalis* is represented by a median, conical eminence lying between the two caudal gills.

The adult mask is almost identical with that of *Micromerus*, the fissure being either open or its edges overlapping apically so as to enclose a small foramen. It is remarkably flattened, and elongated, reaching in juveniles to the base of the hind legs and in adults to the middle pair.

The gizzard, which was examined with some difficulty owing to the larvæ having hardened in alcohol, has sixteen folds, each bearing a row of four to five teeth.

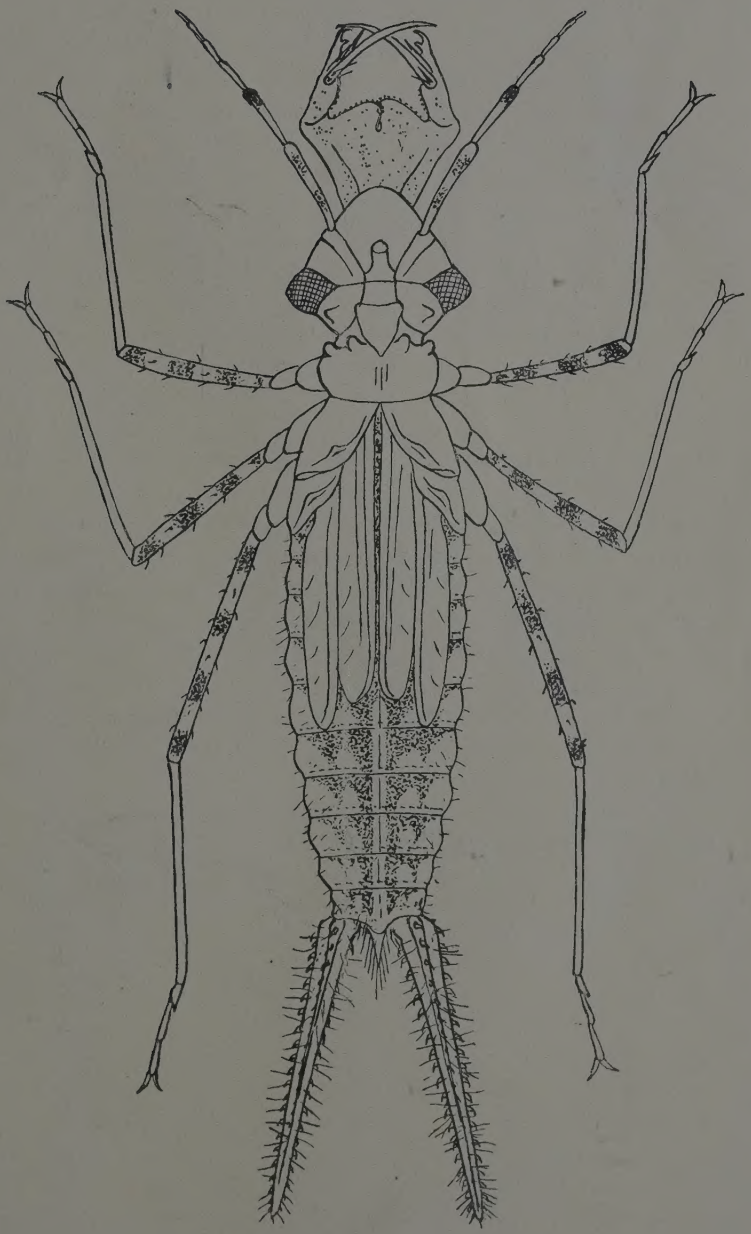
The total length of the adult larva is 24·5 mm., abdomen 11 mm., caudal gills 7·5 mm.

The larvæ were collected in running streams on débris in turbid water at Shillong on 11th May 1920.

DESCRIPTION OF THE LARVA OF *Rhinocypha bisignata*, SELYS (Plate X).

One larva from Kallar, Nilgiri District, *ca* 1,500 ft., collected by T. Bainbrigge Fletcher, 27th February 1920. One exuvium from Khandala, *ca* 2,000 ft., 8th May 1920.

The former specimen was taken amongst weed, the latter was found clinging to a clay bank about six inches above the water line of a small stream over which a large number of the adult insect was flying or perched on twigs overhanging the stream.



ADULT LARVA OF *RHINOCYPHA BISIGNATA*, SELYS.

The females of this insect and of *Micromerus lineatus* are difficult to distinguish from one another when at rest and if no males be present, the only guide to go upon, unless the insects be captured and examined, is the relatively larger size of the former. The two insects are rarely found together although they may occur in the same district and prefer similar haunts, such as a rapidly flowing stream, overhung and densely shaded by trees and shrubs. Both breed in rapidly flowing, and clear streams.

Bearing these facts in mind, it is not surprising to find that the two larvæ bear the closest resemblance. To bring this out, I have sketched the larva of *R. bisignata* of the same size as that of *M. lineatus*, shown in the *Records of Indian Museum*, Pl. XXIII, p. 198, Vol. XVI (1918), although the former is actually and relatively larger.

In *R. bisignata* the pigmentation on the legs and abdomen is of a more uniform density and that of the abdomen is of a less intricate character than in *M. lineatus*. The second joint of the antennæ has two pale ' own rings and the third is tipped distally with blackish brown, the remaining segments being unpigmented. ¶ The caudal gills are shorter and armed with more robust spines.

The mask is similar in shape but the fenestration and overlapping of its edges is not so well marked. The lateral lobes are armed with three hooks and, viewed laterally, resemble a three-fingered hand , the upper hook is long, slender and jointed at its base, the middle one about half the length of the former, whilst the inferior hook is laminate and bifid at its extremity, thus resembling the cheliped of a crab. The lobes overlap widely across the middle line.

The close resemblance between the two larvæ suggests a closer alliance between *Micromerus* and the Group *bisignata* of *Rhinocypha* than exists between the latter and the remaining groups.

PREFACE

The tour on the results of which the following notes are offered, was undertaken during the first three weeks of October 1920, in company with the Imperial Entomologist. The primary object I had in mind was an examination of the dipterous fauna of the Khasia Hills, in greater detail than the existing records afforded, with a view to checking an impression, gained in the study of Indian insect distribution, that the fauna of these hills has a close affinity with that of the Island of Ceylon. To this end no particular attention was paid to any special group which would tend to limit the time available for making captures in the entire order, of which every specimen was taken as it came to hand. That the Imperial Entomologist and Mrs. Bainbrigge Fletcher, who most ably plied a third net in the party, should make over to me for study their dipterous captures, was a kindness which puts me under yet another obligation to them, for, without their help, the facilities obtained could not have been enjoyed. His long experience of the locality enabled the Imperial Entomologist to point out to me the best collecting grounds, which is no slight advantage when the time available is limited.

The first to draw attention to the similarity of insect distribution between these two far distant portions of the Indian Sub-Region was the Imperial Entomologist, who, in a paper in *Spolia Zeylanica* referred to it in connection with the distribution of the Pterophoridæ and Orneodidæ in the Lepidoptera. This, of course, is one of the best known of all the Orders of insects, whilst the Diptera are probably the least known, and it is hoped that the many species now recorded from the Khasia for the first time may, when incorporated in the forthcoming Catalogue of Indian insects, render the distribution of the species in this at least as accurate for these regions as in other Orders, so that, when the volumes have appeared, it may be possible with the aid of the distributions thus indicated to more accurately re-define the faunal Provinces and Zones of the Indian Sub-Region. Though there have been considerable, though still pitifully small, accessions to our knowledge both of species and their distribution since the last attempt at this was made by Lefroy in 1909, it is not the present generation which can hope to see such laid down with any

approach to finality. Still, in the light of the importance of knowing approximately the area which is liable to be affected by an insect which has declared itself a pest in any locality, everything which will tend to improve our knowledge of the boundaries of these zones is of value. Past records have not been searched for references to occurrence; a full list of species known from the area can be made from the Indian Insect Catalogue when this appears. These notes are merely preliminary to that catalogue.

Of previous investigators of the flies of Assam the following are worthy of special mention:—Col. Hall, who collected largely in Sylhet; the Rev. Mr. Pettigrew, who worked in Manipur; Chennell, who made collections of Tabanidæ (but apparently of no other family), on the lower slopes of the northern face of the Khasia itself; and Dr. and Mrs. Kemp, who in a three months' tour of the Garo Hills brought back a collection to which Brunetti, who partially worked it out, has paid tribute. In a search for the possible occurrence of *Glossina* in India, which was undertaken at the instance of the Medical Authorities, following on Sir David Bruce's incrimination of that genus in the transmission of sleeping sickness, assistants from Pusa did some collecting around Nongpoh. The present Imperial Entomologist has made collections, in common with all Orders, on his various visits to the Hills, which have been partially worked out by Brunetti, whose report on the small collection brought back by Dr. Kemp from Aborland during the expedition of 1912 has served me as a model for the present effort.

The Khasia Hills are situated between East longitudes 91° and 92°, and North latitudes 25° and 26°; whilst for comparison's sake it might be mentioned that Ceylon lies between longitudes 80° and 82°, and latitudes 6° and 10°. With the Naga, Jaintia and Garo Hills the Khasia form a spur thrown off from the north and south range,—comprising the Patkoi Mountains, Chin Hills and Arrakkan Yoma,—which bound the Himalaya on the east, but they are of a different geological formation. Mainly inhabited by tribes in a complete state of savagery, it is only on the Khasia portion that general travel can be undertaken.

Much of the ground traversed during the tour is famous in the history of Indian biology, having been explored botanically by Sir Joseph Hooker as far back as 1850. The seven months spent by this great Scientist among these hills are recounted in his classic *Himalayan Journals*, and most of the spots mentioned in these notes will be found referred to therein. The northern slopes were not visited; to traverse the seventy miles from Gauhati, the present route of approach, being, as Hooker explains, then almost certain

death. This tract is still as fever-haunted as it was then, but it is no longer necessary to spend a night in crossing it.

The extreme prolificness of the locality, botanically, was emphasized by Hooker, whilst the Imperial Entomologist has drawn attention to the same condition in regard to the insect fauna. In regard to Diptera, it is certainly the most wonderful area that I have had the good fortune to explore. Nothing in Ceylon can approach it. For the benefit of any other worker who may be in a position to continue the investigation of the Flies of these Hills I would indicate the following places as likely to prove especially productive of results :— The Government Fruit Farm at Shillong, with the Pine Forest above it ; a path through the native village leading from the turn off to St. Joseph's College School to the junction of the two roads below the Lady Minto Nursing Home ; the glade behind the R. C. Cemetery ; and, for localities further afield, the hedges around Mawphlang Dâk Bungalow, and, above all, a small wood about a mile from the Circuit House at Cherrapunji, where most of the mosquitoes were captured. For lower elevations, the scrub around Nongpoh Dâk Bungalow, and the jungle behind the Slaughter House at Gauhati. At the former, in the brief half hour's halt that traffic regulations on the road permit of, I obtained species at the rate of one per minute,—which, though I have never had to work against time in similar fashion elsewhere, I do not think I have ever approached before. If adequate protection could be obtained against malaria, I would place this spot as the finest collecting ground I have ever encountered.

The tour yielded two hundred and eighty-one species, of which nineteen, and a variety, are described as new in another portion of this memoir. How many of my captures in the dozen families in which identification is not yet possible will ultimately prove new, it is impossible even to hazard a guess. Judging by my experience of the numerical extent of the Ceylon dipterous fauna in the only locality where I have fully investigated it over some years, the percentage of the probable number of species existing on the Shillong plateau obtained does not exceed twenty.

In the ensuing notes, species recorded from Ceylon, or obtained there by myself, are marked with an asterisk(*).

RONALD SENIOR-WHITE.

OFFICE OF THE MALARIOLOGIST,
Suduganga, Matale, Ceylon,
15th September 1921.

Elevations of places referred to :—

Gauhati, *ca.* 180′ : Burnihat, *ca.* 600′ : Nongpoh, *ca.* 1,800′ : Shillong, 4,908′ : Mawphlang, *ca.* 6,000′ : Laitlyngkot, *ca.* 5,500′ : Dumpep, *ca.* 5,000′ : Cherrapunji, 4,455′ (heights in feet). Though nearly as high in elevation as Shillong, the temperature at Cherrapunji, with a Southern exposure, is considerably higher than at Shillong, facing North to the Himalaya.

NOTES ON INDIAN DIPTERA.

BY

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[*Lately Acting Dipterist on the Staff of the Imperial Entomologist.*]

[Received for publication on 6th December 1921.]

I. NOTES ON THE DIPTERA OF THE KHASIA HILLS.

CECIDOMYIDÆ.

Asphondylia osbeckiæ. (sp. nov.) A single female, taken early in the morning on flowers of *Osbeckia*, was the only member of this family obtained during the tour. The extraordinary angulated ovipositor (Plate XV, fig. 1) shows special adaptations of an unknown nature. Hitherto only one species has been known from the Khasia, in fact our very fragmentary acquaintance with the family in India is almost entirely confined to Ceylon and the South Indian part of the Ceylonese province. The family must be as abundantly represented in the Assam Hills as anywhere in the East, but it needs special methods of collecting, and hence, in a tour of this nature, numerous captures in it were not to be expected. No deformations on *Osbeckia* were noticed, but no special search was made.

MYCETOPHILIDÆ.

Until now only three species of this family have been recorded from the Hills. A considerable number are known from Sylhet, but what knowledge we have of the family in India is otherwise almost entirely confined to the Himalaya and Ceylon, and many instances of double distribution recorded cannot safely be accepted until the Hills of the Peninsula have been worked.

Sciara brunniventris. (sp. nov.) The unique type was taken at Cherrapunji.

Sciara sp. (near *diversipes*, Brun.). A female from Shillong, in jungle, is either this Eastern Himalayan species or so near it that I cannot separate it with certainty. It differs by the less thickened antennæ and the pale mid femora.

Sciara flavicollis. (Brun.) Taken at Cherrapunji and Dumpep.

Sciara fletcheræ. (sp. nov.) The unique type of this beautiful and distinct species was kicked up among long grass on the river bank at Laitlyngkot, and was taken resting on the author's back by the Imperial Entomologist.

Sciara hirtilineata. (Brun.) A single male, in jungle, Shillong, is this species, previously recorded from the Himalaya, west and east.

Sciara hirtilineatoides. (sp. nov.) Two specimens, Shillong.

Sciara khasiensis. (sp. nov.) The unique type was another of the notable results of a dull, cold day in unpromising-looking country at Laitlyngkot.

**Sciara nigripennis.* (Brun.) Three specimens from Shillong and one from Cherrapunji. The only member of the genus previously recorded from the Khasia,—widely distributed, known also from Simla, Kumaon, Darjiling, Sarawak and Ceylon (Pattipola, 6,000 feet).

Sciara sp. A female in bad order, from Laitlyngkot, I cannot identify. It runs down to *parallela* in Brunetti's key,—in other words, it possesses no distinctive characters of any kind.

**Mycomyia ferruginea.* (Brun.) Four specimens, all from Shillong, two taken in pine forest. Known also from Darjiling, Calcutta and Peradeniya. On the wing it is distinctly a hymenopterous mimic.

**Allactoneura cincta.* (de Meij.) Specimens from Nongpoh, Shillong and Cherrapunji. The species is widely distributed, being known from Nepal and Ceylon to Formosa. Previously recorded in Assam from Sylhet and Kobo (N. E. frontier).

Exechia brevicornis. (sp. nov.) The unique type in pine forest, Shillong.

Exechia longicornis. (sp. nov.) Very like the preceding, but the antennæ are much longer; both species being known from males. Shillong, in deep shade.

Exechia flava. (sp. nov.) Cherrapunji. This is very near Brunetti's *basilinea* from the Himalaya, but is, I think, distinct. The uncompressed abdomen is hardly in accord with the other species of the genus known to me.

Exechia mirastoma. (sp. nov.) The unique type of this species, the extraordinary mouth parts of which, when understood, will doubtless involve the erection of a new genus for its reception, was taken in pine forest, Shillong. It is greatly to be hoped that sufficient material will come to hand to enable the structure to be properly made out. I do not care to mutilate the unique type.

The discovery that this genus, hitherto only known as Indian on one species from the Himalaya, is common in the Khasia and Ceylon, is a better proof of community of fauna than many specific identities.

Mycetophila khasiensis. (sp. nov.) The unique type from Shillong, on a window.

There is nothing remarkable in the discovery of so many new species of this family,—which owing to the small size and ordinary appearance of most of its members has been very litte collected.

CHIRONOMIDÆ.

In spite of Kieffer's work in this family, 'the fringe,' as Dr. Annandale has remarked, 'has merely been touched,' in regard to Indian forms. None have been hitherto recorded from the Khasia, though some Sylhet species have been described, and our knowledge is mainly confined to the Ganges Delta, with a certain number of species from Ceylon. Kieffer's work is extraordinarily difficult to follow, and personally I seldom feel sure of even generic definitions made thereby. Hence, one naturally pays less attention to members of this family than would otherwise be the case. For this reason even my Ceylon collections are less complete in this than in any other family, Cecidomyids not excepted. During the tour only seven species were obtained, which seem to belong as follows:—*Chironomus*, two species, both Shillong; (?) *Cardiocladius*, two species, one from Shillong, the other from Nongpoh, but both differing from an unnamed Ceylon species in my collection provisionally assigned to that genus by the immensely swollen and spined fore femora; *Procladius*, one species, Shillong. From pupæ in a rotten shoot of bamboo, which had died when a few inches above ground, at Shillong, three females of a *Forcipomyia* and four males of a (?) *Metriocnemus* were bred, emerging at Pusa in November, though they would probably have overwintered in the pupal stage if left at Shillong. Though both species are represented by specimens of a single, and opposite sex, there is at least no doubt that two species of very different genera are present. None of these species are represented in my Ceylon collections.

PSYCHODIDÆ.

Yet another family entirely unknown from the Khasia, where they do not appear to be common, as only two species were captured.

Pericoma metatarsalis (Brun.) var. *khasiensis*, nov. In the description I have given reasons for considering these specimens at least a good variety of this western Himalayan species. They were abundant, running in circles in

the usual fashion, on broad leaves on a hedge at Mawphlang, which was the only occasion in which the family was at all in evidence. Only a few survived capture in sufficiently good state to pin, as owing to rain my net was not in a fit state for taking such delicate insects.

Pericoma sp. A single male from Shillong represents, apparently, a new species near *impunctata* (Brun.), but I do not like to describe in this family from unique sepcimens, as dissection is essential if structure is to be properly made out.

A small species, of which no specimens seem to have survived, was noted as attracted to freshly dropped cowdung at Shillong, and may possibly have been *Psychoda nigripennis* (Brun.), which breeds in this material. None the less, the apparent absence of this genus is interesting, as in Ceylon it is much more prevalent than *Pericoma*, being represented in my collections from the Island in the proportion of five to one, and recorded in Brunetti's recent catalogue in the proportion of four to one.

CULICIDÆ.

Though the mosquitoes of Assam are fairly well known, it would appear that serious collections have been made only in Sylhet and the Lushai Hills, for from the Khasia I have only been able to find a single species definitely recorded. A hurried collecting tour devoted to the order in general is not likely to furnish anything like a complete tally of the mosquitoes present even at the time of one's visit, but none the less the collection made proves a most interesting one, and has resulted in adding two species to the Indian list. The Malayan element in the fauna is, as might be expected, most marked. The collection was worked out at Kasauli by Major Christophers, C.I.E., I.M.S., to whom my best thanks are due. The most productive locality was the small wood, referred to previously, at Cherrapunji, and it is at this station alone that my diary notes mosquitoes troublesome at night. This, of course, refers to the Hills; mosquitoes at Gauhati made the night a purgatory only comparable, in my experience, to a bad mosquito night at Kanthalai, near Trincomali.

**Anopheles gigas.* (Giles) Dumpep, in dâk bungalow, at dusk. This is the only species heretofore recorded.

**Anopheles maculatus.* (Theo.) A gorged female in bedroom, after a very cold night on October 20th, Shillong.

Armigeres apicalis. (Theo.) In wood, Cherrapunji.

**Armigeres obturbans.* (Wlk.) One male, Shillong.

**Stegomyia trilineata.* (Leic.) Many specimens, in deep jungle at the mouth of Maosmai Cave, near Cherrapunji. It was noticed that they attacked

our Khasia guides much more than we suffered ourselves, which is contrary to what one would expect.

**Ochlerotatus ostentatio.* (Leic.) Cherrapunji. A Malayan species also recorded from Peradeniya.

Ochlerotatus pulchriventer. (Giles). Cherrapunji. Hitherto only known from Naini Tal.

**Ochlerotatus vexans.* (Meij.) Cherrapunji, Dumpep and Shillong, several specimens. The species apparently ranges from Canada to Fiji, but not into Africa.

**Culex mimeticus.* (Noë) Shillong and Cherrapunji. These specimens are the true *mimeticus*, and not the tropical *mimulus*, Edw.

**Culex tritæniorhynchus.* (Giles) A female from Shillong, in bedroom, and a male from Gauhati, in jungle, identified as this species by Major Christophers, do not appear to me to be conspecific with specimens identified as the same species from Ceylon, having the wing scales broader, and leaning more towards *sitiens*, Wied. Our knowledge of the very difficult group of *Culex* comprising those species with a banded proboscis is still insufficient.

Culex univittatus. (Theo.) One male, Shillong. This African species had previously been recorded from Singapore, and now comes on to the Indian list for the first time. Its occurrence in such a remote locality absolutely disproves any idea that it is a recent introduction to Asia by shipping, which the Singapore record would easily warrant.

**Culiciomyia viridiventer.* (Giles) Five males, resting in a flooded pit latrine at Laitlyngkot. I feel sure that there is a *mélange* of species under this name. Bred originally at Naini Tal in a waterfall, it is a far cry from such a habitat to a flooded latrine, or a water butt, from which I bred it in Ceylon. I cannot conceive of any single species with such diverse tastes.

**Tæniorhynchus brevicellulus.* (Theo.) Captured at Gauhati.

Tæniorhynchus ochraceus. (Theo.) A pair from Cherrapunji. This species was captured by Mrs. Bainbrigge Fletcher, who thus adds to our fauna one of the most beautiful species of the family, known previously only from Kuala Lumpur. This is one of the most interesting captures of the whole tour.

Mansonioides annulipes. (Wlk.) Taken at Burnihat and Gauhati. A Malayan species hitherto recorded in the Indian sub-region only from Calcutta.

**Mansonioides uniformis.* (Theo.) A female in jungle, Gauhati.

At neither Gauhati nor Burnihat did I notice any *Pistia stratiotes.*

**Aedes butleri.* (Theo.) Gauhati. A Malayan species recorded also from Colombo. Identified with a certain amount of doubt.

Uranotœnia testacea. (Theo.) Three females in bed of stream in jungle, Gauhati. Hitherto known only from the Malayan sub-region, and recorded in our fauna only from the Dawnat Range, Tenasserim.

DIXIDÆ.

Dixa montana. (Brun.) A male taken on our last day in the hills, at the Crinoline Falls, Shillong, proves to belong to this species, previously known only from the Simla Hills, where it appears common.

BIBIONIDÆ.

Crapitula melanaspis. (Wd.) Shillong, Dumpep and Cherrapunji. Previously recorded from the Khasia. It was very common around heaps of old, rotted cowdung, in which it was breeding, mature larvæ and pupæ being found in the dung and in earth close by.

Plecia tergorata. (Rond.) Cherrapunji. Previously recorded from the Khasia.

Dilophus gratiosus. (Big.) Three specimens, from Shillong. Not previously recorded, though it occurs from the western Himalaya to Yunnan.

SIMULIIDÆ.

Simulium aureohirtum. (Brun.) A male of this widely, but erratically, distributed species, which was previously known from Umling in these hills, was taken at Shillong hovering before flowers of a cultivated composite.

Simulium metatarsale. (Brun.) A male from Shillong. Brunetti hardly sufficiently emphasizes the extraordinary development of the hind metatarsus of this species, which is so vastly in excess of the quite sufficiently remarkable incrassation of the joint in the other Indian species. Hitherto only known from the unique type from Kurseong.

TIPULIDÆ.

The Tipulidæ of the Khasia are better known than most other families, whilst most of the species collected by Dr. and Mrs. Kemp in the Garos, on the same range further to the west, bring to our knowledge species which will probably be found, ultimately, on the Khasia also. The Ceylon element in the fauna is very small, showing how local are these insects.

Ctenacroscelis dives. (Brun.) A male was taken on the first day's collecting at Shillong, and no further specimens were seen. It was apparently too late in the season for the occurrence of these giant forms. This species has hitherto only been known from the Darjiling District.

Tipula fumifasciata. (Brun.) Shillong and Laitlyngkot. A Chinese species, hitherto only recorded in our region from Manipur, this record extends its distribution a good deal further westwards.

Tipula himalayensis. (Brun.) Common at Shillong, taken also at Mawphlang and Dumpep. Previously recorded. The legs of my specimens are rather more yellow than the description indicates, and the preapical femoral yellow rings are indistinct, especially on the fore legs.

Tipula quadrinotata. (Brun.) A female from Cherrapunji. Known previously from Darjiling and Manipur, its occurrence on the intervening range was to be expected.

Tipula tenuipes. (Brun.) A single specimen from Shillong. Previously recorded from Sylhet only.

Tipula sp. Two females from Laitlyngkot apparently represent a new species near *tenuipes*, but are in too bad order to describe.

Pachyrrhina consimilis. (Brun.) Laitlyngkot and Cherrapunji. Distributed from Peshawar to the Khasia.

**Pachyrrhina javensis.* (Dol.) A pair from Shillong. A Malayan species also found in Ceylon. Previously recorded from the Khasia and the Garos.

Pachyrrhina serricornis. (Brun.) Shillong, Mawphlang, Laitlyngkot, Dumpep and Cherrapunji. Common everywhere. Occurs from Lahore to Yunnan, and possibly also in Japan.

Dicranomyia cuneiformis. (de Meij.) A male from Cherrapunji. Known previously from Java, North Kanara and Tenasserim.

Dicranomyia nitidithorax. (sp. nov.) The unique type from Shillong.

Dicranomyia pulchripennis. (Brun.) Shillong, two females previously recorded.

Dicranomyia sordida. (Brun.) Common, taken at Shillong, Cherrapunji, Dumpep and Laitlyngkot. Previously only recorded from the Darjiling District.

Geranomyia pulchripennis. (Brun.) Cherrapunji, known previously from Shillong.

**Geranomyia semistriata.* (Brun.) Four specimens, from Shillong, whence it has been previously recorded, as also from Cherrapunji by Kemp. Occurs at the four-thousand-foot level in Ceylon (Maskeliya).

Atarba flava. (Brun.) Cherrapunji. Hitherto only known from Darjiling where it is common in the autumn (Brunetti).

Molophilus inconspicuus. (Brun.) A specimen from Shillong, and another taken on grass at mile-post 25 on the Cherrapunji road, appear to be this species, which is known from the Himalaya and Travancore.

Erioptera grandior. (Brun.) Dumpep. Previously only recorded from Simla.

Acyphona indica. (sp. nov.) The unique type from Shillong. The genus occurs in the East in Java, but has not hitherto been found in the Indian sub-region.

**Gonomyia conjugens.* (sp. nov.) The types are from Shillong and Matale, in Ceylon, respectively.

Gnophomyia strenua. (Brun.) A single specimen from Shilliong supplements the unique type from Darjiling.

Gnophomyia sp.—A male from Cherrapunji lacks a head and is unidentifiable.

**Trentepohlia trentepohlii.* (Wd.) A female from Gauhati of this widely distributed species, which was not seen in the Hills.

**Conosia irrorata.* (Wd.) This widely distributed species has apparently not been recorded hitherto either from Ceylon or the Khasia, where a single specimen was taken at Shillong. In Ceylon it occurs, but rarely.

Amalopis novempunctata. (sp. nov.) The unique type of this very beautifully marked species was taken at Shillong.

Limnophila fletcheri. (sp. nov.) Several specimens of this new species, from Shillong and Cherrapunji.

Limnophila fusca. (Brun.) A male from Cherrapunji. Hitherto only known from Darjiling District.

Limnophila multipunctipennis. (sp. nov.) Two examples, Shillong.

Eriocera maculiventris. (Brun.) A female from Gauhati, resting on a tree in scrub jungle. Known only from the Garos, at a considerable elevation, hitherto.

Eriocera plumbolutea. (Edw.) A male, flying over a stream, Shillong. The unique type is also from the Khasia.

Eriocera semilimpida. (Brun.) Shillong, in marshy ground opposite the Convent. Apparently confined to the Khasia.

STRATIOMYIDÆ.

Ampsalis longispinus. (Brun.) A male of this beautiful Tenthredinid mimic flew into the verandah of a bungalow on a dull afternoon, Shillong. Previously recorded from Shillong and Darjiling District.

**Negritomyia maculipennis.* (Macq.) A female from Nongpoh of this species, which has hitherto been recorded only from Ceylon and Coorg in our region, though known also from the Philippines, Moluccas and Papua.

Ptecticus aurifer. (Wlk.) A male from pine forest, Shillong; the species extends from Masuri to Borneo. In flight is extremely pseudaposematic.

**Sargus mactans.* (Wlk.) Shillong and Gauhati, four examples. A somewhat widely distributed species. It might be noted that Howlett's figure in *Indian Insect Life* (Plate LXI, fig. 3), is of this species, and not *metallinus* F., as stated.

**Michrochrysa flaviventris.* (Wd.) A female from Burnihat, flying round a pond in heavy shade, belongs to this widely distributed species.

As was to be expected, the Stratiomyidæ collected represent the family but poorly. It is far more abundant in the Plains.

TABANIDÆ.

In spite of the large number of species recorded from the lower ranges of the Khasia northern face, Tabanidæ seem extraordinarily scarce on the Shillong plateau. No specimens were taken during the tour and none have previously been recorded, though I have seen one or two from Shillong in the Pusa collection of this family, which has not yet been worked out.

BOMBYLIIDÆ.

**Exoprosopa insulata.* (Wlk.) A female of this widely distributed species was taken flying slowly over grass on the last day of the tour at Shillong, probably just warmed out from the chill of the previous night.

Exoprosopa latipennis. (Brun.) Eight examples of this beautiful species, which is apparently confined to the Khasia, were taken hovering over a grass bank by the Survey Department offices at Shillong, on 8th October. The species was seen nowhere else and on no other occasion, and I understand that the Imperial Entomologist has taken it just here in previous years.

What was probably a *Systropus* was seen, and missed, at Dumpep, where the high wind that was blowing on the day of our visit made everything very wild.

THEREVIDÆ.

Thereva flavolineata. (Brun.) This handsome species, which seems to be entirely confined to the Khasia, is represented by a female from Laitlyngkot, taken flying round *Prunus nepalensis.*

ASILIDÆ.

It is as yet impossible to identify Indian species of this family, though Mr. Brunetti is at present engaged in working them out. Of the eleven species

taken, ten belong to the Asilinæ, and one to the Dasypogoninæ, the other two sub-families not being represented. Of the Asilinæ, four species belong to *Ommatius*, (*s. l.*) three to *Machimus*, two to *Neoitamus* or an allied genus, and one to *Philodicus*, being very near a Ceylon species of that genus belonging to the four-thousand-foot level, differing in the number of posterior dorso-central bristles only. One sp. of **Ommatius*, taken at Shillong, is actually conspecific with a Ceylon species occurring in the foot hills. One of the *Neoitamus* species was taken with prey, a Lymantriad moth, at Shillong, and was also taken at Nongpoh, which is a wide distribution in elevation. The family was most abundant, proportionally, at Dumpep, where possibly the grass land formation nourished an Orthopterous fauna yielding suitable prey. The high proportion of species belonging to *Ommatius* is noteworthy.

EMPIDÆ.

**Hybos apicis*. (Brun.) A male from Nongpoh belongs to this species, which, although only recorded from Tenasserim, is common at 1,300 feet in Ceylon.

Hybos bisetosus. (Bezzi.) Five males, from Shillong, appear to be this species, described from the Western Ghats at 2,600 feet, but the tomentum on the thoracic depression is brilliant gold, not grey, as stated. The tips of the hind femora are much more blackened than Brunetti's key (but not Bezzi's description) would lead one to expect, and the former author's *tenuipes*, concerning the validity of which he expresses a doubt, is probably good.

DOLICHOPODIDÆ.

I have postponed the working out of my entire collection in this family until the results of Becker's examination of the Zoological Survey's collection have been published. Of the eight species of the family taken during the tour four belong to *Psilopus*,—(*one common to Gauhati and Ceylon at all levels from 500 to 4,000 feet),—one common to Shillong and Gauhati, and the other two represented by a few specimens of apparently localized species found at Mawphlang and Gauhati respectively. The genus seems poorly represented on the Hills of North India as compared with Ceylon, where it is predominant, being even more scarce in Darjiling collections received from Mr. Shaw of the Govt. Cinchona Plantations, Mungpu. Of the remaining species, two belong to *Dolichopus*, one represented by a single Gauhti specimen, the other, which I know also from Mungpu, from Shillong and Dumpep. A **Diaphorus* from Gauhati occurs in Ceylon, and with a single specimen of a *Sympycnus* from Gauhati completes the tale of a family which

in any Ceylon collection made over the same period and elevation would be far more abundantly represented. As it is, the majority of the species came from Gauhati, and not the Hills proper.

PHORIDÆ.

Aphiochæta flavifacioides, sp. nov. The unique type, from Cherrapunji, represents the only specimen of the family obtained, but as special methods involving breeding are required for its adequate investigation, this is not to be wondered at.

PLATYPEZIDÆ.

**Platypeza argyrogyna*. (de Meij.) A long series from Shillong and Gauhati. The Shillong specimens are extremely large as compared with those taken in Ceylon, but the difference is more apparent in life than in the box. The Khasia form is *obscura* (Brun.), but at Gauhati the form with yellow first and second tarsal joints makes its appearance. Neither shows the white shimmer on the thorax to the extent Ceylon specimens do.

PIPUNCULIDÆ.

An undescribed *Pipunculus*, from Dumpep, represents this family. As in this, so in the two succeeding ones, the long delayed publication of Brunetti's third 'Fauna' volume on the Order has to be awaited for determinations to be made of any but the most well-known species.

SYRPHIDÆ.

This family is, undoubtedly, the most prominent feature of the fly fauna of the Khasia. To any one who, like myself, is only acquainted in the East with the sparse and unremarkable representatives of the family in South India and Ceylon, the abundance of handsome species comes as a revelation.

(?) *Paragus* sp. A pair from Shillong appear to belong to an undescribed species in this genus.

(?) *Pipiza* sp. A female from Shillong.

**Syrphus balteatus*. (de Geer.) As common here as elsewhere. Specimens from Shillong, Dumpep, Laitlyngkot and Cherrapunji.

Syrphus confrater. (Wd.) Two females from Cherrapunji appear to be this species, which is widely distributed in North India.

**Syrphus ericetorum*. (Fb.) Another widely distributed species, represented by a pair from Shillong and a male from Gauhati. The Shillong female was flying in company with *Exoprosopa latipennis*.

Syrphus spp. Two species, one represented by a female from Dumpep, the other, which I also have from Mungpu, by a pair from Shillong.

**Sphærophoria javana.* (Wd.) Three males from Shillong.

Sphærophoria nigritarsis. (Brun.) A pair from Shillong and two females from Dumpep are of this species.

Sphærophoria viridænea. (Brun.) A female from mile-post 25 on the road to Cherrapunji, amid grass downs.

**Sphærophoria* sp. A very common Ceylon form, represented by two females from the marsh in front of the Convent, Shillong, I cannot identify with any of the described species. It seems to belong to an intermediate between Brunetti's 'forms 1 and 2.' I have seen the same species from Banhar, in North Bihar. In all these specimens the last two joints of the hind tarsi are dark, a character of which Brunetti makes no mention.

Sphærophoria sp. A single female from Shillong, apparently represents yet another species, or form, in this genus, in which it is interesting to note that the common and widely distributed *scutellaris*, Fb., is not represented. Two species of the genera with pedunculated abdomen allied to *Baccha* occur, one from Shillong, Cherrapunji and Dumpep, the *other from Shillong only, but represented in my collection by specimens from various localities in Ceylon, and from Pusa.

(?) *Orthoneura* sp. Two males from Shillong, and two females from Cherrapunji apparently belong here.

(?) *Melanostoma* spp. Four species, one from Shillong only, *two from Cherrapunji in addition, the *fourth from both places and Mawphlang, apparently belong here. The three last mentioned are all found in Ceylon, and I have two of them from North Bihar also.

Rhingia sp. An undescribed species from Shillong and Cherrapunji, both females. At the latter place the specimen was hovering before the door of the Circuit House, and was taken for a Bombylid exploring the key hole.

Eristalis tenax. (L.) As common at Shillong as it appears to be at Darjiling. A male from Laitlyngkot.

Eristalis spp. Four species, which I cannot identify. *One of them I have also from Ceylon and Banhar, another, very common at Shillong, also from Darjiling. The other two are not represented from elsewhere in my collection.

Megaspis chrysopygus. (Wd.) A male, on flowers of a composite, in a garden, Shillong, was the only one seen. Being on a mere 'after tiffin' stroll neither of us had a net handy, and its capture by hand by the Imperial Entomologist was no mean feat! A wonderfully striking species.

Megaspis errans. (Fb.) A male from Shillong.

**Megaspis zonalis.* (Fb.) A female of this beautiful species from Shillong. It occurs, but rarely, in Ceylon also.

Eumerus spp. Two species of this genus from Shillong, but neither was at all common, or agrees with species from other localities in my collection.

CONOPIDÆ.

Physocephala sp. A male resting on a blade of grass in the swamp, Shillong, belongs to a species which I also have from Sukna, at the foot of the Darjiling Himalaya, and is the only specimen of the family collected during the tour.

ACALYPTRATA.

Our knowledge of the Indian families in this sub-order is more than incomplete—it may be said to be non-existent. Here and there a genus, and one family, the Trypetidæ, have been worked out, but until India obtains the services of another Brunetti to blast a track through the jungle of forms, obfuscated as it is by the misdirected efforts of Walker and Bigot, but little progress can be expected. The work cannot be done in India. In the Nematocera we are dealing with families most of whose species are of fair size and possess noticeable separatory characters, probably also a somewhat restricted distribution, but here we reach a mass of obscure and small species which are often either of wide distribution or closely allied, and the described species of which are in all probability entirely wrongly allocated as to genera. As a pre-requisite to further study, the elucidation of the types of the heretofore described species is essential, and this can only be done in Europe. A prominent species, here and there, may be safely identified from literature, the remaining descriptions only represent an inchoate mass. It is peculiar that, so far as my experience goes, jungle country is much less productive of species than is cultivated, but this may really be due only to their normally small size rendering them inconspicuous and overlooked in wild surroundings. In the present collection not very many species were obtained, and all I can attempt, save in Trypetidæ, in which Bezzi's working out of the Zoological Survey's collection forms a ground work, is to indicate such Ceylon affinities as I have found. It is useless to run any particular species down to a modern genus and, finding that genus unrepresented in the East, to thereupon describe the species as new, Walker has probably, already described it several times and allocated his various synonyms to some totally unlikely genus, probably that from which the family takes its name. I write from my experience in working out the Muscidæ in collaboration with Major Patton, I.M.S., and there is no reason

to suppose that Walker was any more careful in Acalyptrata than in the higher Muscoids.

BORBORIDÆ.

Represented by a single species from Laitlyngkot and Mawphlang.

CHLOROPIDÆ.

Seven species, one common.

EPHYDRIDÆ.

Two species, apparently belonging to *Notiphila*, are represented by single specimens from Laitlyngkot and Dumpep respectively. A *third species, belonging to a genus not included in 'Williston'; is found in Ceylon and at Cherrapunji.

DROSOPHILIDÆ.

A (?) **Leucophenga* sp. I have from Shillong, Mungpoo and Ceylon, and of a species of **Stegana*, which I have bred from beneath decaying *Hevea* bark in Ceylon, I obtained a single specimen at Cherrapunji. Five other species were taken *one of which also occurs in Ceylon.

AGROMYZIDÆ.

Three species, *one of which is also found in Ceylon.

SEPSIDÆ.

Of the three species obtained,* two are also known to me from Ceylon.

MICROPEZIDÆ.

* *Texara dioctrioides*. (Wlk.) A single specimen from Mawphlang; the species is not uncommon in Ceylon, and was originally described from Celebes. It is probably a Braconid mimic.

Calobata spp. Two closely allied species which mimic an Ichneumonid of the *Lissonata* group. The Shillong species, with black antennæ, I have not seen from elsewhere; *the Gauhati species, with yellow antennæ, is common in Ceylon. These are the most wonderful mimics known to me; the use of the front legs to imitate the vibrating, white-ringed antennæ of the hymenopteron is marvellous.

ORTALIDÆ.

**Stenopterina cænea*. (Wd.) A pair from Nongpoh of this common scatophilous species, which apparently does not ascend the hills further, although I have it from 4,000 feet in Ceylon.

No other species of this very large family were taken. It is apparently as poorly represented here as it is in Ceylon, from which, after years of collecting, I only possess ten species.

DIOPSIDÆ.

Teleopsis spp. Three species, one from Cherrapunji, two from Gauhati, are so closely allied that they may possibly be only forms of a single variable species. All are represented by single specimens, and I have seen nothing like them from elsewhere.

SAPROMYZIDÆ.

Thirteen species, of which *five are also found in Ceylon. One of these is from Gauhati, one, (a *Lonchæa*), common to Gauhati, Shillong and N. Bihar, the others from Shillong and Cherrapunji. Another Gauhati species is also found at Pusa. Of the remainder, six belong to the higher levels, one to the Plains at Gauhati.

TRYPETIDÆ.

**Chætodacus caudatus.* (Fb.) A single specimen of this widely distributed species from Shillong.

Chætodacus scutellaris. (Bezzi.) Two females from Shillong, whence the species has already been recorded. Occurs from Almora to the Shan States.

Chætodacus scutellarius. (Bezzi.) Two females from Shillong belong to this species, hitherto only known from Mysore.

Tæniostola vittigera. (Bezzi.) Two pairs, resting on the underside of leaves in the bed of a stream overhung with jungle, Gauhati. This beautiful species is apparently confined to Assam.

Rioxa vaga. (Wd.) A female taken in company with the previous species appears to be this, though in some respects the wing agrees with Walker's description of his *mutyca*, possibly the two are but varieties of a single species. The latter is recorded from Sadiya, at the head of the Brahmaputra Valley.

Elaphromyia pterocallæformis. (Bezzi.) A single specimen from Cherrapunji of this species, hitherto known only from the Western Himalaya. It mimics a homopterous insect.

Tephritis tribulicola. (sp. nov.) Breeds in the gigantic thistle which is one of the features of the Shillong flora. Specimens from there and Mawphlang. The thistle seems to be confined to the same country as *Pinus khasiana*, hence the non-appearance of the fly at Cherrapunji and Dumpep.

It will thus be seen that, in the only Acalyptrate family in which accurate determination is possible, only one widely distributed species is common to the Khasia and Ceylon. That the known distribution very imperfectly represents

the actual facts is shown by the breeding from flower heads of *Gonicaulon glabrum* at Nagpur of *Craspedoxantha octopunctata*, (Bezzi.), a species hitherto confined to its unique type from Tenasserim, a district about as remote in character from the Central Provinces as any other in the Empire. More careful collecting will probably reveal many other species besides those which are pests of cultivated plants to be of wide distribution.

ANTHOMYIDÆ.

This is the most impossible family of all the sub-order, the very English species are only now being cleared up, and individual species are known to be of extraordinarily wide distribution. Twenty-six species were taken on the tour. Of them, a **Lispa* is common to Ceylon, Mungpu and Shillong, another *species, of undetermined genus, I have from Ceylon, Pusa and Shillong; *another from Ceylon at 4,000 feet, Burnihat, Laitlyngkot and Dumpep, also from Coonoor; *another from the low country of Ceylon, Gauhati and Cherrapunji. Of the remaining species twenty are from high levels, two of them occurring at about equal elevations on the Nilgiris, and two from the Plains.

CALYPTRATA.

Muscidæ.

The Indian species of this family are now undergoing revision and elucidation by Major Patton, I.M.S., and myself, and this work is still far from complete. It is not possible, therefore, to name everything taken on the tour, or to guarantee that the name given a species in these notes will not be supplanted later on by the discovery of an older one, but the majority of the species have been identified with some description. The distribution in the family is so wide that the absence of the commoner species from any station is of greater interest than their presence, denoting the operation of some as yet uncomprehended factor for that species. For example, a special search was made on the Khasia for *Musca cingalaisina* (Bigot), (*Philæmatomyia indica*, Awati), without result, and although the species is known from as far North as Delhi it apparently fails to reach the Khasia, much more closely allied though this is to Ceylon than is the Gangetic Plain.

All determinations, except in Rhiniinæ, have been gone over by Major Patton.

**Musca nebulo.* (Fb.) The common housefly at Shillong, Mawphlang, Laitlyngkot and Cherrapunji. Its replacement in this office at Gauhati by the next species is of peculiar interest.

Musca sp. *incert.* (P. & C.) This species, which still lacks[1] an exact determination, was the common fly in the Gauhati bazaar on the date of our visit. This is unusual, as the species does not commonly function as a house-fly.

**Musca humilis.* (Wd.) Shillong, Nongpoh and Gauhati.

**Musca ventrosa.* (Wd.) A single male from Nongpoh. Searched for in vain at Shillong.

Musca (?) *setigera* (Awati). (*convexifrons* P. & C., *nec* Thoms.) A single male from Mawphlang of this interesting species, the name of which is still in doubt.[2]

**Musca gibsoni.* (P. & C.) Shillong, Mawphlang, Dumpep, Cherrapunji and Nongpoh. Usually more or less confined to the Hills in India, although it reaches sea level in Ceylon.

**Musca pattoni.* (Aust.) Shillong, common. A pair from Nongpoh.

**Musca bezzii.* (P. & C.) Shillong, Laitlyngkot and Cherrapunji. Common.

**Musca lineata.* (Brun.) A single female from Shillong.

**Musca crassirostris.* (Stein) Cherrapunji, Nongpoh and Gauhati.

Pyrellia sp. A large larviparous species from Gauhati, Shillong, Mawphlang, Laitlyngkot and Cherrapunji. Occurs also in the Darjiling District.

**Pseudopyrellia* (?) *lauta.* (Wd.) Cherrapunji, Nongpoh and Gauhati. Another very common species which is absent from Shillong and the higher levels.

**Bdellolarynx sanguinolentus.* (Aust.) Three specimens from Shillong.

**Stomoxys bengalensis.* (Pic.) A single specimen from Shillong appears to be this species.

**Stomoxys calcitrans.* (L.) Everywhere along the road from Gauhati to Cherrapunji.

**Lyperosia exigua.* (de Meij.) A male from Gauhati belongs to this widely distributed species, which was not found in the Hills.

Calliphora aucta. (Wlk.) Described by Walker as a '*Musca*,' this species has never heretofore been recorded from any certain locality. One specimen, at food, Dumpep. It is larviparous.

**Chrysomyia megacephala.* (Fb.) Cherrapunji, Nongpoh and Gauhati. Not seen at Shillong although naturally a species which, if present, intrudes itself.

Chrysomyia pinguis. (Wlk.) Several specimens from Shillong. Occurs also on the Nilgiris.

Chrysomyia putoria. (Wd.) A pair from Shillong.

[1] Since described by Patton (*Ind. Journ. Med. Res.* X 71-73; July 1922) as *Musca incerta*; but, as that name is an absolute homonym of *Musca incerta*, Walker (1856), this fly is still without a valid name.—T. B. F.

[2] According to Patton, this is *M. albomaculata*. Macq.—T. B. F.

Lucilia inducta. (Wlk.) One of Walker's 'green and gold' *Muscas*! Common at Shillong, one specimen from Laitlyngkot. Occurs in the Eastern Himalaya and the Nilgiris.

**Lucilia* sp. An unidentified species, larviparous in human excrement, was obtained at Gauhati. I know it from up to 1,300 feet in Ceylon, and it has been taken at the foot of the Nilgiris. It apparently does not attain a high elevation.

**Borbororhinia pubescens.* (Towns.) The first female to come to hand was taken by the Imperial Entomologist on a flowering tree in the Club compound, Shillong. Described from Cochin, it is not very rare in Ceylon. This is the first record outside the Ceylonese Province.

**Chloroidia flavifrons.* (Towns.) A single specimen of this, the most beautiful of Indian Muscidæ, was seen, and lost, at Shillong. Fairly common at times in Ceylon. Described from Mergui and Cochin, it is probably a Malayan species entering the Empire at the two ends which have affinities with that sub-region.

Idiella euidielloides. (sp. nov.) Types and another specimen from Shillong, the former taken on a flowering tree by the Imperial Entomologist.

Euidiella quadrinotata. (Big.) Four specimens from Shillong and Dumpep appear to be this Bornean species, which I have also from Mungpu. The basal pair of yellow abdominal spots is obsolescent.

It is interesting that among the wealth of species in this sub-family obtained at flowers in Shillong, the commonest of all, *Euidiella discolor* F., was not obtained.

**Strongyloneura nepalana.* (Towns.) A male from Shillong. This widely distributed North Indian species is common in Ceylon.

Strongyloneura viridana. (Towns.) A pair from Shillong. Known also from Calcutta and Sadiya.

Synamphoneura cuprina. (Big.) A pair from Gauhati appear to be this Malayan species, which I have also from North Bihar. Previously recorded from Assam.

Pollenia sp. Four females from Shillong, two taken sucking Aphid honey-dew, apparently represent a new species near *rudis*, but I refrain from describing them at present.

Polleniopsis (?) *pilosa.* (Towns.) Four specimens of what I take to be this species, but Townsend's specific description is so inadequate that consultation of his type is necessary, and this is not possible at present. The type is a male and these specimens are all females and differ by the legs being black, and in other minor points.

A *Bengalia* was seen, but lost,—through a hole in the net. The numerous burrs which the Shillong flora produces are not conducive to undamaged nets; in spite of repairs I used four in the three weeks!

SARCOPHAGIDÆ.

Another family in which type elucidation is essential to any progress. With fourteen species of Walker's, two of Desvoidy's and three of Macquart's (to say nothing of others by workers less reckless in description), which require homologizing, nothing more can be said about the two species of *Sarcophaga* obtained than that *one is as common in Ceylon as at Shillong and Cherrapunji, and the other species, also from the same Khasia localities, is represented in my collection by that great desideratum in this genus, a pair *in cop.* from Pusa.

DEXIIDÆ.

Of the eight species taken, *two are common to the Khasia and Ceylon. One of these, (?) *Prosena* sp., occurs from sea level to 4,000 feet in Ceylon, and at Shillong and Cherrapunji, where it abounded. It is very fond of resting on pine trunks at Shillong. Of the remaining species, five are from Shillong and the higher elevations, one from Gauhati. One of the former is a wonderful hymenopterous mimic in black and yellow, and was taken flying slowly, which is most unusual in this family, over a stream near the Fruit Farm at Shillong. Slow flight is a sure sign of effective protection.

TACHINIDÆ.

Unless a worker who is capable of comprehending the writings of Brauer and von Bergenstamm and of Townsend can be found to devote his whole time to the Indian species of the family I fear that the present generation of entomologists will see but little progress made in our knowledge of these important parasites. It is a matter of extreme difficulty, save in the case of a few well-marked species, to decide whether any two specimens are, or are not, conspecific. My captures appear to belong to twenty species, only one of which, a beautiful yellow *Bombyliomyia* from Laitlyngkot amid long grass, I can with any certainty refer to even a genus, and to conspecificness with numerous other specimens from Mungpu at various elevations between two and five thousand feet. The other species are represented by one to three specimens each, mainly from localities of equal elevation, but one species was taken at Shillong and Nongpoh. The single species from Gauhati was not seen higher up. One Shillong species, with black thorax and wings and flattened, orange abdomen, is in flight a Reduviid mimic. None of the species have any affinity with those known to me from Ceylon, or, with the exception quoted, from the Eastern Himalaya.

PUPIPARA.

The common *Hippobosca maculata* (Lch.) was not seen anywhere, which is most surprising.

No shooting of bats was done, and so the *Nycteribiid fauna* is unrepresented.

The captures in each family are summarized below. It will be seen that the proportion of species occurring common to the faunas of the Khasia and Ceylon is approximately the same for each of the five (out of the six), great divisions of the Order which were obtained. The community of type thus indicated is fairly high, and may be said to confirm the impression which the tour was designed to verify; but, until the Palnis, Nilgiris and Chota-Nagpur Hills have been subjected to similar investigation, whether this similarity is one of station or of region, must remain in doubt.

It is greatly to be hoped that these localities may be similarly explored.

Family	No. of spp. captured	No. of spp. also known from Ceylon	Percentage of spp. common to both areas
Cecidomyidæ	1	..	..
Mycetophilidæ	16	3	19
Chironomidæ	7	..	..
Psychodidæ	2	..	..
Culicidæ	18	12	75
Dixidæ	1	..	..
Bibionidæ	3	..	..
Simuliidæ	2	..	..
Tipulidæ	31	5	16
NEMATOCERA	81	20	24
Stratiomyidæ	5	3	60
Bombyliidæ	2	1	50
Therevidæ	1	..	..
Asilidæ	11	1	9
Empidæ	2	1	50
Dolichopodidæ	8	2	25
Phoridæ	1	..	..
BRACHYCERA	30	8	27
Platypezidæ	1	1	100
Pipunculidæ	1	..	..
Syrphidæ	28	8	28
Conopidæ	1	..	..
ASCHIZA	31	9	29

Family	No. of spp. captured	No. of spp. also known from Ceylon	Percentage of spp. common to both areas
Borboridæ	1	..	..
Chloropidæ	7	..	..
Ephydridæ	3	1	33
Drosophilidæ	7	3	43
Agromyzidæ	3	1	33
Sepsidæ	3	2	67
Micropezidæ	3	2	67
Ortalidæ	1	1	100
Diopsidæ	3	..	..
Sapromyzidæ	13	5	38
Trypetidæ	7	1	14
Anthomyidæ	26	4	15
ACALYPTRATA	77	20	26
Muscidæ	32	18	56
Sarcophagidæ	2	1	50
Dexiidæ	8	2	25
Tachinidæ	20	..	..
CALYPTRATA	62	23	37
THE ORDER	281	80	28

2. NOTES ON THE TABANIDÆ IN THE COLLECTION OF THE FOREST ZOOLOGIST.

I have recently received for study from Mr. C. F. C. Beeson, Forest Zoologist, a collection of about ninety specimens in this family, collected by Dr. Cameron, Mr. S. N. Chatterjee and himself, mainly in the Western Himalaya and Burma, but including a few specimens from other localities. Both the Western Himalaya and Burma are notorious for Surra, and in view of the importance of an accurate knowledge of the distribution of species in this family for correlation with the distribution of the disease, the etiology of which is, as regards the transmitting agent, still obscure, the collection is of great value. Practically nothing is known of the Tabanidæ of Upper Burma, where the disease is so rife that, according to Captain Enriquez, the trade route to Yunnan is closed for several months of the year, through the Chinese muleteers refusing to expose their animals to its ravages, while the remoteness and difficulty of access of the locality is such that material is almost impossible to come by in the ordinary course. Hence the thanks of the Agricultural Department are due to Mr. Beeson and his Staff, whose tours take them into localities seldom visited by officers of the Agricultural Service,

for material which otherwise there would be considerable difficulty in obtaining.

The material forming the collection has been returned to the Forest Zoologist's collection at Dehra Dun. The various new species discovered are described in another part of this Memoir.

Tabanus excelsus. (Ric.) Ten females from Muthrwala, Dehra Dun, on 30th and 31st October 1919, and one female from Masuri on 18th June 1920. This species was described from ' a long series in bad condition.' In the present specimens the following points at variance with the description are to be noted :—the tarsi are darker than the tibiæ, which may be almost whitish, not yellow ; the median triangular abdominal spots are almost linear. In many specimens the two calli are joined by an obvious line, often nearly as broad as the upper callus, making rubbed specimens very misleading. This is probably figure 13 of Plate IV of Leese's paper on Tabanidæ taken at Mohand. Previously only recorded from Mashobra, Simla District.

Tabanus leucocnematus. (Big.) One female from Mohnyin Reserve, Katha, Upper Burma, at light, on 19th May 1919. Previously only known from the Khasia and Lushai Hills in Assam. I have a female in my own collection from Mungpu, Darjiling District, taken on 19th May 1920. Its capture on the same date in two successive years in localities so far apart probably indicate that it is a Spring species, and is really found along the Eastern Himalaya and the Assam Hills to those of the Yunnan Frontier. Miss Ricardo's wording of her key in this group is misleading ; the apices of the front tibiæ are black.

Tabanus sexcinctus. (Ric.) This species, previously known from the Lushai Hills and Formosa, is represented by two pairs from Masuri, the dates ranging from 21st May to 29th June 1920.

Tabanus kakhyenensis, sp. nov. Three females from Mohnyin Reserve, 15th to 19th May 1919. A pair from Pyonchaung, North Toungoo, on the 22nd of the corresponding month, and two females from Yanaungmyin, Pyinmana, on 3rd and 9th June 1918, indicate that this also is a pre-Monsoon species.

Tabanus auriflamma. (Wlk.) Two females of this magnificent species from Nambor Reserve, Sibsagar, Assam, on 15th May 1921, a locality from which it has previously been recorded. Extremely pseudaposematic in appearance.

Tabanus sp. nov. From the same locality on the same date, Mr. Beeson sends a new species in Group VI, belonging to the same section as the last, with the first posterior cell open, which I refrain from describing until further material is available, as I am not certain to what extent the specimen before me is rubbed.

Tabanus striatus. (Fb.) A female of this widely distributed species from the Sunderbans, 24th February 1915, and what is probably the male of this species from Dehra Dun on 15th August 1919. The males of *rubidus*, Wd., *albimedius*, Wlk., and *striatus*, Fb. are so similar that separation on ordinary characters is uncertain, and no examination of the genitalia appears to have been made.

Tabanus albimedius. (Wlk.) A male from Masuri, in June 1920, I refer with some doubt to this equally widely distributed species.

Tabanus hirtistriatus. (Ric.) Three females from Mohyin, on 18th May 1919, are probably this Malayan species. They differ from the description as follows :—frons much less narrowed anteriorly, almost parallel ; the extension of the callus sometimes reaching the vertex ; the palpi practically without black pubescence, and the first two antennal joints with only a trace of such ; the front tibiæ are only yellow basally, and, in one specimen, the posterior tibiæ are only black at the apex. The abdomen is more yellow than the description would indicate. The specimens would agree better with the description of the series of males from the Dawnat Range, Tenasserim, doubtfully referred to this species by Miss Ricardo, and possibly two very closely allied species are involved, one of which still lacks a name.

Tabanus sp. near *hirtistriatus.* Two females from Bendaung apparently represent a new species near the above. They are very much larger. With only literature to guide me I refrain from describing them.

Tabanus monotæniatus. (Big.) Six females from Mohnyin, on 18th and 19th May 1919. This record joins up the two previously recorded localities of the North Khasia and Yunnan. Two specimens are of the blackish, and the others of the reddish, brown-abdomened variety.

Tabanus brunnipennis. (Ric.) Three females, from Mohnyin, on 19th May 1919. This is a very distinct species, and its extraordinary recorded distribution, North Kanara, North Bihar and Bangkok would indicate, with the present record, that it is a Malayan species, and on the Western Ghats represents the Malayan element visible in South India and Ceylon.

Tabanus auristriatus. (Ric.) Two females from Mohnyin, on 19th to 24th May 1919, I refer, with a doubt, to this species. One specimen has the antennal teeth prominent and only the apical ring of the third joint black. The frons is slightly narrowed. Previously only known from North Kanara.

Tabanus jucundus. (Wlk.) A female from Masuri, in July 1920. The extension of the callus is clavate at the tip. Previously recorded from this locality.

Tabanus rubicundus. (Macq.) Two females from Petsut, Katha, on 15th and 21st June 1921. Recorded previously from Assam and Java. I am

not sure whether there are not two species mixed up under this name. Comparing these specimens with one from Ceylon in my own collection, these have the antennal teeth much more pronounced and a very long appendix at fork of the third vein. If the relationship of appendix and strong teeth proves constant over a series, the type of Bigot's *monilifer*, sunk here by Miss Ricardo, should be examined for the latter character, and, if present, the name resurrected for such specimens.

Tabanus fuscomaculatus. (Ric.) Five females, from Masuri on various dates in June 1920, and a very large female from Kumaon, June 1914. Previously recorded from Myitkyina and Sikkim, the range of this species is thus extended far to the westward. These specimens present the following differences from the description :—antennæ red, only the apical ring of the third joint black ; the last four abdominal segments black and all finely pale margined, (Miss Ricardo states that the species has the antennæ black all over the third joint, whilst her subspecies, *altermaculatus*, from Manipur, has the antennæ all red) ; the tips of femora and tibiæ are yellow, but the tarsi are distinctly black except for the reddish under fringe. The black spot on the third segment may be lost in a general darkening of that segment. The species is probably variable and *altermaculatus* is possibly not a valid subspecies but only an extreme variation.

Tabanus oxyceratus. (Big.) From Masuri, a male on 17th May 1920, and two females in June of the same year. Previously recorded from this locality.

Tabanus sp. near *oxyceratus.* A female from Bangar, Chakrata, U. P., at 6,000 feet on 1st May 1921, belongs to a species not included in the Oriental fauna. The antennæ are all black and the abdominal segmental rings yellowish without a trace of spots, the scutellum is not whitish. This locality is far within the Western Himalaya, and has produced other Palæarctic species, such as *Chorisops tibialis*, Mg. (Stratiomyidæ, a specimen of which is included in the collection before me), and it will be necessary to compare this species with Central Asian ones belonging to the Palæarctic fauna before deciding whether it is new.

Tabanus orientis. (Wlk.) Three females from Mohnyin, on 16th May 1919. Known from Dungagalli to Yunnan, this is the first Burmese record for the species.

Tabanus fuscicauda. (Big.) One female from Okkyi, Shwegu, on 27th May 1919. Previously known from Ceylon, Sumatra and the Andamans. The Burmese agrees with Sumatran specimens in that the black mark on the second abdominal segment is absent.

Hæmatopota striatipennis. (Brun.) A male from Dehra Dun on 17th January 1910. This is the type locality and the species is not known from elsewhere. It is most extraordinary that the female has never been found, and it may be quite unlike the male, as in some African species. Brunetti states that the species falls in Group II, with the base of the front tibiæ whitish, but in the specimen before me the legs are all brown, bringing it into Group I. This mode of grouping, however, does not work with males, for the male of *javana*, Wd., has the legs all yellow in many specimens.

Hæmatopota beesoni sp. nov. One female,' on wing,' 11th May 1918, two females taken biting elephants 17th May 1918, all at Bondaung.

Hæmatopota javana. (Wd.) A male from Dehra Dun, in July 1913; a female from Kaiang Reserve, Pyinmana, 4th May 1919, a female from Bendaung, at light, 12th May 1918; and nine females, biting elephants, at the same place, on 17th May 1918. A widely distributed species, not hitherto recorded from Burma. The species seems not uncommonly to come to light; I have recently received one male and four females thus obtained at Banhar in North Bihar, in July and August 1921, from Mr. H. A. Inglis.

Hæmatopota fuscifrons. (Aust.) Three females, Mohnyin, 15th to 23rd May 1919. One specimen has the mid tibial middle ring absent. Not previously known from Burma. Recorded hitherto from ' India ' and ' Bengal.'

Hæmatopota burmanica sp. nov. Two females from Bendaung on 17th May 1918. Biting elephants.

Hæmatopota sp. nov. A small species from the same place as the last, on 11th May 1918, apparently represents a new species in Group VI F, but as it is unique I refrain from describing it.

Chrysops dispar. (Fb.) One female from the Upper Dihing, Lakimpur District, is an exceptionally large example of this widely distributed species.

Chrysops flavocincta. (Ric.) One female, Mohnyin, 23rd May 1919, A Malayan species recorded in our region from the Khasia, Ceylon and Travancore.

Much less attention has been paid to *Hæmatopota* than to *Tabanus* in regard to Surra transmission, but it is significant that no less than three species of the former genus, and none of the latter, are recorded as biting elephants which are said to suffer from the disease.

3. NEW SPECIES OF DIPTERA FROM THE INDIAN REGION.

CECIDOMYIDÆ.

ASPHONDYLIA OSBECKIÆ, sp. nov. (Plate XV, fig. 1.)

♀. *Head* grey, vertex with long yellowish hairs, Antennæ about as long as the thorax, brown, 2+12 jointed. Scapal joints short, sub-globular, flagellum

with first joint the longest, the next seven subequal, though each is very slightly shorter than the preceding one, about three times as long as broad; ninth about one and a half times as long as broad, tenth as long as broad, eleventh half as long as broad, twelfth very flattened ovate, wider than long. Hairs on basal half of each joint yellowish brown, about as long as the joint itself, on apical half much shorter. The two 'filets' on each flagellar joint as illustrated by Kieffer for his *Parasphondylia* on Plate XII, fig. 3 of fascicle 152 of '*Genera Insectorum*,' save that the lower 'filet' is situated at two-thirds instead of half the length of the joint, the connecting bar being correspondingly shortened. Palpi pale yellow, the palpiger minute, globular, first and second joints sub-equal, elongate, apical half as long again.

Thorax: dorsum shining black with the submedian lines thickly golden-brown haired; shoulders, seen from above, pale yellow. Pleuræ blackish, except pro-and ptero-pleura, which are yellowish. Dorsopleural suture with strong hairs in front of wing roots. Scutellum yellow, metanotum dark. Submedian hairs continued across the scutellum.

Abdomen with basal segment pale yellowish, remainder dark brownish with thick, rather paler, hairs. Ovipositor as long as the body, two-jointed, the second joint at right angles to the first, and twice its length, the needle-like terebra as long as both together. Basal joint with fine longitudinal striations, apical with very short erect pile, slightly longer on distal half. The whole ovipositor brownish yellow.

Legs dark brownish black, coxæ and trochanters a little paler. Pulvilli as long as ungues.

Wings greyish, thickly haired. Halteres with basal half of stem yellow apical half and capitellum black.

Long (without ovipositor) 1·25 mm.

Described from a ♀ taken on Osbeckia flowers, Shillong, 5th October 1920.

Type, partially dissected, in my own collection.

A true *Asphondylia*, unless the palpiger be admitted as a joint, in which case it falls into Kieffer's *Parasphondylia*, if this be admitted a valid genus, which I am inclined to doubt.

MYCETOPHILIDÆ.

Sciara brunniventris, sp. nov.

♀. *Head* black, vertex and face with greyish shimmer. Occiput with short black hairs, a fan of stiff bristles over mouthparts. Antennæ blackish, scapal joints shorter and broader than the flagellar, subequal, the tip of the

second white. Flagellar joints subequal, the first about three and a half times as long as wide, all with pale pubescence. Extreme base of first joint paler. Palpi three jointed, the first joint slightly thickened basally, as long as the second, the third nearly as long as both together, with an apical stiff hair stronger than the other soft hairs of the organ. Eyes bare.

Thorax blackish, shining, sides concolorous. Dorsal margins showing white viewed from above owing to minute grey dusting only visible in certain lights. Median and dorso-central rows of black bristles, the median ending in line with the wing roots, the exterior rows reaching the posterior margin, and becoming stronger posteriorly. Lateral margins in front of wing roots and postalar calli with strong bristles, the concolorous scutellum with some short hairs on the disc towards the hind margin as well as around the margin itself, which bears also two apical much longer bristly hairs.

Abdomen uniformly yellowish brown, the posterior margin of the fourth to seventh segments dorsally and laterally (but not ventrally), blackened to an increasing width, so that only the extreme base of the seventh shows paler. Eighth segment and the two-jointed lamellæ of the ovipositor black.

Legs: fore coxæ pale brown, posterior coxæ dark brownish. All femora pale brown, tibiæ slightly and tarsi rather more darkened. Tibial spurs yellow.

Wings pale hyaline grey, veins brownish. Auxiliary vein hardly reaching the origin of the third, which occurs at one quarter the length of the wing; anterior cross-vein and basal section of fourth vein of equal length. First vein ending slightly beyond the fork of the fourth, of which the petiole and branches are equal. Second posterior cell four and a half times as long as broad. Fifth vein forking near base, the branches diverging suddenly at half length; sixth vein stopping half way to wing margin. Halteres dark.

Long 4 mm.

Described from a unique female in good condition, taken at Cherrapunji, Khasia Hills, on 18th October 1920. In my own collection.

Easily separates from the other species in couplet 8 of Brunetti's table of Indian species on the yellow femora.

Sciara fletcheræ, sp. nov.

♀ *Head* black, vertex and face with soft hairs, the latter also with greyish shimmer in certain lights. Eyes markedly pale pubescent. Antennæ; scapal joints very dark brownish, the second shorter than the first, flattened spheroidal; scape slightly paler brown with pale pubescence, first thirteen joints subequal, the basal three times as long as wide, apical joint half as long again as the penultimate. Palpi black, three-jointed, the basal joint incrassate, acuminate,

the second thin, the third slightly broader than the second, with the tip elongate mammiliform ; all joints subequal. Proboscis black.

Thorax: dorsum and pleura black, somewhat shining, humeri and propleura yellow-brown, the dorsum with only scattered black pubescence, stronger hairs laterally in front of wing roots and on postalar calli. Scutellum concolorous with several transverse depressions, and an apical fringe of soft black hairs.

Abdomen: dorsum and venter black ; laterally a broad, uninterrupted primrose yellow stripe (fading in drying to mustard yellow). Ovipositor with the usual black lamellæ.

Legs : coxæ and trochanters black, fore femora yellowish brown, posterior pairs brownish black, all tibiæ and tarsi concolorous, the tibial spurs yellow.

Wings dark greyish black, veins hardly darker. Auxiliary vein long, extending distad of origin of third vein, which arises at one-third length of wing. First vein ending beyond fork of fourth vein, of which the petiole and branches are subequal, the second posterior cell four and a half times as long as broad. Fifth vein forking near base of wing, the branches sharply diverging at half length, sixth vein rather long but not reaching wing margin. Halteres with yellowish stem and dark capitella.

Long 4·5 mm.

Described from a unique female in good condition, taken in grass land along the river bank, Laitlyngkot, Khasia Hills, on 16th October 1920. In my own collection. The specimen fell to the net of the Imperial Entomologist, and I have much pleasure in dedicating the species to Mrs. Bainbrigge Fletcher, who, like her husband, was good enough to turn over to me all her dipterous captures throughout the tour, thus adding largely to the number of species obtained. The yellow fore femora separate this species at once from the others in couplet 9 of Brunetti's Indian table.

Sciara hirtilineatoides, sp. nov.

♀. *Head* black, face somewhat knobbed. Antennæ black, the first flagellar joint slightly longer than the others, which are subequal, all with minute pale pubescence. Palpi black, first joint rather longer than either of the others, which are subequal.

Thorax black, marked as in *hirtilineata* (Brunetti), with four grey stripes. the three dividing black lines bearing, however, very much shorter and sparcer pale hairs. Shoulders not paler, concolorous. Scutellum absolutely bare of marginal hairs, the dorsal margins of the thorax similar.

Abdomen black, with sparce pale hairs on dorsum, sides and venter pale brown. Female genitalia not elongate.

Legs black, the fore and hind femora show brownish in certain lights. Tibial spurs all black.

Wings black, venation as in *hirtilineata*, but the second posterior cell is quite four times as long as broad. The length of the wings to that of the body is also greater than in Brunetti's species. Halteres blackish.

Long 2·75 mm. Wings 5 mm.

Described from 2 females type in perfect condition, co-type with antennæ broken, both taken at Shillong, on 13th October 1920. In my own collection.

Easily separates from *hirtilineata* on the much darker wings and legs. It is a relatively stouter insect.

Sciara khasiensis, sp. nov.

♂ *Head* black, face grey dusted. Eyes bare. Antennæ, scape dark brown, with first joint broader than the second, truncate, second globose; flagellum with first seven joints shortly pedicillate, remainder sessile, all subequal except the first joint, which is slightly longer than any of the others. Base of first joint pale, remainder, and whole of next five joints black, the remaining joints to the apex greyish brown. The colour difference between the sixth and seventh joints is not extremely marked, but between the base and apex of the flagellum it is quite apparent. Palpi of three very short joints, black.

Thorax: dorsum very dark brown, nearly black, with dorso-central rows of pale, short hairs, and similar, longer rows along side margins. Notopleural suture and postalar calli chestnut brown, pleura concolorous, except sterno-and meta-pleura, dark brown. Scutellum chestnut brown, its base darker, with apical hairs. Metanotum dark brown with paler sides.

Abdomen blackish, with the usual black, two-jointed lamellæ.

Legs: coxæ, trochanters and femora bright brownish yellow, tibiæ paler in ground colour, but with closer set black setulæ, apical spurs reddish- brown, tarsi blackish.

Wings almost clear, veins yellowish brown. Auxiliary vein short, only reaching half way to origin of third vein, which arises at half the length of the first. First vein just passing the fork of the fourth, of which the petiole is slightly longer than the branches, second posterior cell five times as long as broad. Upper branch of fourth vein slightly up-turned at tip. Fifth vein forking near base, its branches sharply diverging at half length. Sixth vein ending half way to wing margin. Halteres with yellow stem and dark capitella.

Long 3·75 mm.

Described from a unique female in good condition taken on grass along river bank, Laitlyngkot, Khasia Hills, on 16th October 1920. In my own collection.

This species separates from *Sc. flavofemorata* in Brunetti's table of Indian species, in couplet 11 by the longer second posterior cell and the paler wings and tibiæ.

CEROPLATUS NOTATICOXA, sp. nov. (Plate XIV, figs. 6, 12.)

♂ ♀. *Head* pale to dark yellow, blackened on vertex, and with a median dark line, broadened below, on face. Palpi very short, closely appressed to face, probably two-jointed, the basal very short, pale, the apical elongate reniform, black. (In the figure of the head the palp is shown pulled away from the face and not in its natural position.) Antennæ brown, the scape in some specimens darker than the flagellum. Eyes pubescent.

Thorax: dorsum ferrugineous brown, with very short erect black pubescence, and with traces of a pair of black lines converging V-like posteriorly. The posterior corners and scutellum darker brown, the latter with similar erect pubescence on the disc and without long bristles marginally. The bristles along the dorso-pleural margin very short, but numerous in front of the wing roots. Shoulders and pleura pale yellowish white, the former very noticeable from above. Posterior margin of hypopleuron blackened. Metanotum yellowish, its median area darker.

Abdomen pale yellow-whitish, thickly covered with black hairs, each segment with an apical black band, which in the male occupies most of the first segment and on the others not more than the apical quarter or fifth. In the ♀ the whole dorsum is more or less blackened, the pale colour only showing faintly towards the bases of the segments, male genitalia with basal joint of claspers large, fleshy, pale, the apical black, densely short haired. Female lamellæ yellow, downward-directed, apparently arising from a common plate which is much narrower than the preceding tergite, and standing well separated from the end of the abdomen.

Legs pale yellowish white, tibiæ slightly and tarsi considerably blackened owing to closely set setulæ. Posterior coxæ with a black spot at one-third their length and just before the tip; the extreme base of all femora blackened, the hind pair rather more broadly. In pale specimens the tip of the posterior tibiæ is also darker.

Wings much shorter than the abdomen in the male about as long in the female. The ground colour is slightly yellowish. A large black patch over

base third and fourth veins, a dark band from costa immediately beyond the upper branch of the third vein, fading away posteriorly, and above the third vein extending into the marginal cell to a varying extent. An apical infuscation, varying in depth and in distinctness of separation from the subapical band. None of the veins beyond the upper branch of the fourth quite reach the margin. Halteres with stem pale yellowish and capitella black.

Long 6–6·5 mm.

Described from eleven males, (including type), taken flying round a decaying stem of *Ficus religiosa* on 11th October 1921, a male taken on window, 22nd December 1919, and a female taken on window, 17th August 1919; all at Suduganga, Matale, Ceylon. Type, allotype and co-types in my own collection.

In describing below two new species of *Platyura*, Brunetti's key to the genus in the "Fauna of India" may be amended to include them. They will both run down to couplet 11, from which point the key will run as follows:—

11. Petiole of fourth vein at least one-third as long as the branches....12
    Petiole of fourth vein much shorter than this.....14
12. Antennæ brownish yellow, all veins distinct.....13
    Antennæ black, veins posteriorly indistinct....*indistincta*, Brun.
13. Thorax bright reddish brown, coxæ and femora yellowish. *ruficornis*, Brun.
    Thorax dull brown, coxæ and femora white.....*juxta*, sp. nov.
14. Head and antennæ mainly blackish, wings unmarked.....*longifurcata*, Brun.
    Head and antennæ mainly yellowish, wings with preapical spot....*lunifrons*. sp. nov.

Couplet 13 of the key will then follow.

Platyura juxta, sp. nov.

♀. *Head* yellowish brown, epistome and palpi darker, ocellar area blackened. Antennæ pale greyish yellow, scapal joints no wider than first flagellar and very short. Occiput thickly black haired: a somewhat prominent small tuft of black hairs above epistomal margin. Eyes minutely pale pubescent.

Thorax yellowish brown, with narrow blackish dorso-central stripes, very indistinct, turned outwards and downwards anteriorly to the black shoulders. Dorsum thickly black haired, the lateral margins and an area between and behind the wing roots with much longer, bristly hairs. Scutellum and metanotum concolorous, the former with about eight strong marginal bristles

and many very short ones arising very slightly below the former. Pleura dull yellowish brown, bare.

Abdomen black, the hind margins of the segments very narrowly dirty yellow. The second segment with the anterior two-thirds of dorsum dirty yellow, and the apical sternite yellow; venter otherwise as dorsum. In specimens with distended abdomen the lateral suture will probably show as a dirty yellow line.

Legs white, tibiæ slightly and tarsi greatly blackened.

Wings smoky yellowish grey, all veins very distinct. There are traces of a dark suffusion below the tip of the third vein. Petiole of fourth vein over one-third the length of the branches. Halteres with stem whitish and capitella darker brownish.

Long 3·75 mm.

Described from a unique female in perfect condition, taken on window, at dusk, Suduganga, Matale, Ceylon, 8th October 1921. In my own collection.

Platyura lunifrons, sp. nov.

♀. *Head* yellow, occiput and face with black hairs: Ocelli within a round, black patch, yellow, prominent. On frons between ocelli and antennæ a raised, luniform transverse area; its upper margin convex, with the extremities fitting into rather deep emarginations in the eyes, and the middle of its concave lower margin produced triangularly, with the apex between the roots of the antennæ; this triangular area with short black hairs. There is a depression across the lunule from below the mid ocellus to the base of the produced triangle. Antennæ yellowish grey, second scapal joint slightly darker than the first, which is yellowish white; first flagellar joint twice as long as second, its lower side emarginate basally, the base of the joint being half the width of the apex; apical joint twice as long as penultimate. Palpi yellowish, the two basal joints much broader than the two apical, but together not much longer than the third joint, which itself is little more than half as long as the still narrower fourth joint.

Thorax yellowish to reddish brown, with black hairs, which are numerous and strong along the dorso-pleural margin, increasing in length posteriorly to above the wing roots, where they become definite bristles, behind which, and on posterior margin, they are much sparcer. Scutellum concolorous, with its apical margin well bristled. Pleura yellowish, with some greyish shimmer, metanotum more greyish. The thoracic dorsum may have a pair of subdorsal brown stripes, but these are not always apparent, or well defined.

Abdomen yellowish brown with black hairs. An impressed transverse line to each segment subapically gives the appearance of concolorous apical bands to the segments.

Legs whitish, tibiæ and tarsi darkened, the latter greatly so.

Wings with distinct yellowish tinge, with a dark patch, more or less oblong in shape, just below tip of lower branch of third vein. Petiole of fourth vein about one-fifth as long as its branches. Halteres yellowish grey with darker capitella.

Long 4·5 to 5·5 mm.

Described from two females in good condition, taken, on windows, Suduganga, Matale, Ceylon, on 25th August 1919, and 9th August 1921 (type). Both in my own collection.

MYCOMYIA UNIFASCIPENNIS, sp. nov. (Plate XIV, fig. 1.)

♂. *Head:* vertex and frons pale brown with black hairs. Ocelli in a darkened area, the median one not distinguishable. A furrow runs from below the ocelli to above the antennæ, where the frontal colour is paler yellowish with no black hairs. Face yellowish, somewhat shining, epistome concolorous, not shining, with fine scattered dark pubescence. Antennæ, scape yellow, the joints apically with black bristles; flagellum, basal half yellow, the apical six or seven joints darkened to brownish grey. First flagellar joint twice as long as the second. Eyes very minutely pale pubescent. Palpi yellow, fourth joint as long as first three together.

Thorax: dorsum shining very dark brownish black. Shoulders pale yellowish white. A short yellow transverse line from in front of wing roots for a short distance upwards. The whole dorsum with black hairs and with strong bristles on anterior margin and corners, along the sides and across the hind margin before the root of the pale yellowish-white scutellum, which bears an apical pair of long, divergent bristles. Pleuræ pale yellowish white, except metapleura, which, viewed from side, are dark brown except lower corner, yellowish, viewed from behind, all yellowish. Metanotum dark brown,—sometimes with traces of a median pale line.

Abdomen dark yellow with black hairs. Second, third and fifth segments dorsally black, with narrow yellow anterior and posterior margins, the darkened area of the two latter descending further towards the wholly yellow venter than on the former, on which it is also narrowed below. Sixth segment varying from all black above—(and without any yellow band separating it from the fifth, on which the hinder band is then absent)—to dark yellow with only a lateral, basal, black spot. Genitalia dark yellow, the corners of the dorsal

platet urned downwards, and covered with golden pile, the tips with a row of hairs. External to these the tips of a subulate pair of claspers, also hairy, can be seen. Beneath the dorsal plate project the blunt tips of a pair of palp-like processes, closely approximated, and with their apices turned downwards. On mid line, ventrally, is a long, curved, thin process, its tip upturned nearly to meet the median processes, apically bilobed, with a tuft of short dark brownish stiff hairs.

Legs: coxæ pale whitish, the hind pair with a median row of bristles on the outer face. Femora yellow, the hind pair slightly darkened on the underside basally. Tibiæ and tarsi darkened, but without any yellow colour, the ground colour, below the closely set setulæ, whitish.

Wings: basal half hyaline yellowish. A median black band, darker above the fourth vein, its inner margin running from just before the tip of the auxiliary vein, across the base of the Sciophiline cell—(the inner upper corner of which is just clear)—slightly outward directed from lower end of the anterior cross vein, with irregular margin, to lower branch of fifth vein, which it meets before half its length, then slightly inwardly directed—(the colour is here much fainter)—to the wing margin just below the fork of the fifth vein. The outer margin of the band is nearly straight, running from just before the tip of the first vein to the tip of the upper branch of the fifth vein. Colour of wing external to the band hyaline grey. Veins yellow, except through the band, where they are black. The tip of the sixth vein, which enters the band, being thus well marked. Costa extending a little beyond the tip of the third vein but not reaching the apex. Sciophiline cell nearly square, its outer and lower sides equal. Halteres yellow.

Long 3·5 to 4 mm.

Described from two males both in good condition, except for the loss of one fore and one hind tarsus in the co-type, both taken on window, Suduganga, Matale, Ceylon, on 15th August 1921, at dusk, and on 17th August 1921, in early morning (type). Type and co-type in my own collection.

If *Neoempheria*, Osten-Sacken, is admitted distinct from *Mycomyia*, Rondani, this species will come in it.

AZANA ASIATICA, sp. nov. (Plate XIV, fig. 4.)

♂. *Head* yellow, vertex, frons and face with dark hairs: palpi concolorous, the first three joints very slightly darker, the first two short, the third and fourth subequal and each as long as the first two together. Antennæ, scape yellow, both joints apically long setose above; flagellum pale brownish grey, thickly pale pubescent.

Thorax: dorsum orange yellow, with three slightly darker stripes, not well defined; scutellum concolorous, both with rough erect hairs of the same and slightly darker shades intermixed. Pleura and metanotum paler yellow. Pro- and hypo-pleura with rows of concolorous hairs.

Abdomen: seven-segmented, yellow, with rather thick concolorous pubescence, the third to sixth segments with a median transverse dorsal brown band, interrupted on the mid line. Genitalia large, complex, wider a little than the seventh segment, the side pieces long and large, touched with brown on their apical margins.

Legs: yellow, tarsi very slightly darkened. Extreme tips of coxæ, trochanters and femora touched with black.

Wings: hardly as long as the abdomen, with setulæ distinctly longer than usual, but not to the extent of *Leptomorphus*. Venation in accordance with the generic definition. Halteres yellow.

Long 3 mm.

Described from a unique male in perfect condition, taken on a window, Suduganga, Matale, Ceylon, on 16th September 1921. In my own collection.

Agrees entirely with Johannsen's definition of the genus in *Genera Insectorum*, except for the seven-jointed abdomen, which being so, somewhat exceeds the wing in length; the genitalia are more prominent than his description would indicate.

MANOTA ORIENTALIS, sp. nov. (Plate XIV. figs. 7, 8.)

♂. *Head:* frons black, short; face yellowish grey with golden hairs, stronger below. Antennæ directed upwards and forwards, brownish yellow 2+14 jointed. First scapal joint broad, short; second apically setose, broader, than the first flagellar. Flagellar joints compact, of approximately uniform length, the apical very slightly longer, all pale pubescent. Palpi pale yellow, very prominent; first joint coniform, the second attached to its outer side at about half its length, leaving a triangular flap projecting backwards behind the insertion of the second joint, which is three times as long as the first joint proximal of the point of attachment of the second; third narrow, not as long as second, directed angularly backwards—(generic character)—the whole organ pale pubescent. Eyes pale pubescent.

Thorax yellowish, with paler pubescence on anterior half of dorsum and black pubescence on posterior half, pleuræ concolorous, as is also scutellum, but with stronger dark pubescence and the apical margin definitely dark, with six marginal dark bristles of which the innermost pair are the longest and strongest. Metanotum pale yellow.

Abdomen yellow, the hinder segments darkened, with dark pubescence, segmental margins distinct but unmarked. Genitalia yellow, small, their structure not apparent.

Legs pale yellow, tibiæ and tarsi darkened owing to closely set setulæ. Mid and hind tibiæ with two apical spurs.

Wings greyish hyaline; third vein approximated to first. Costa ending before apex, but nearer upper branch of fourth than third vein. Fourth vein with only tip of upper branch and all lower branch of fourth present, petiole absent; fifth vein complete, sixth not apparent, seventh strong. Halteres dark yellow, capitella brown.

Long 2·5 mm.

Described from a unique male in perfect condition taken on window, Suduganga, Matale, Ceylon, on 1st September 1921. In my own collection.

The species runs more like a *Phlebotomus* than a Mycetophilid.

This species is at variance with Williston's definition of his genus in that the mid tibia has a double, not a single, spur. Although the third palpal joint is in accordance with the generic definition, the latter says nothing in regard to the remarkable prolongation of the first joint, which is therefore presumably absent in the West Indian species for which the genus was founded. The description of Meunier's fossil species is not accessible to me, but as Johannsen sinks the genus erected by Meunier for it in Williston's living genus, I take it that the palpi show no difference therefrom. In Johannsen's figure of the wing, which is after Williston (*Genera Insectorum*, Fasc. 93 Pl. IV, fig. 21), the petiole of the fifth vein is shown incomplete, which is not mentioned in the generic definition. These trifling differences do not justify the erection of a new genus.

KEY TO THE DESCRIBED SPECIES OF INDIAN EXECHIA.

1. Dorsum of thorax yellow to orange 8
   Dorsum of thorax dark borwn to black 8
2. Dorsal margins, viewed from above, paler than central area 3
   Dorsal margins, viewed from above, not paler than central area 7
3. Larger spp. (5 mm.). All yellow, pale margins ill-defined 4
   Smaller spp. (3 mm.). Pale margins well-defined and usually reaching posterior corners 5
4. Abdomen not compressed—antennæ erect .. .. *flava*, sp. nov.
   Abdomen compressed—antennæ porrect .. .. *basilinea*, Brun.
5. Dorsum bright orange, margins brilliant silvery .. .. *argenteofascia*, mihi.—*a.*
   Dorsum with darker stripes, margins whitish 6
6. Abdomen with dorsum all black .. .. .. *mirastoma*, sp. nov.
   Abdomen with dorsum of fourth and seventh segments white .. *albicincta*, sp. nov.
7. Dorsum with paler median V-mark bordered by erect bristles, posterior subdorsal area brownish .. .. .. *cristata*, mihi.

	Dorsum all yellowish brown, no definite markings	*zeylanica*, mihi.
8.	Pale lateral margins broader, extending across base of scutellum, central black patch narrowed anteriorly	*ampullata*, mihi.
	Pale lateral margins narrower, not extending across base of scutellum, central dark patch with median markings ..	9
	Pale lateral margins wanting	*paramirastoma*. sp. nov.
9.	♂ antennæ longer than head and thorax	*longicornis*, sp. nov.
	♂ antennæ shorter than head and thorax	*brevicornis*, sp. nov.

EXECHIA ALBICINCTA, sp. nov.

♀. *Head*: black, frons covered with pale silvery hairs. Epistome dark yellow, palpi pale yellow. Eyes with microscopic pale pubescence. Antennæ, scape and first three flagellar joints yellow, remainder brownish with white pubescence.

Thorax: dorsum dull yellowish brown, the sides, viewed from above, obscurely whitish. A pair of subdorsal dark stripes, fading away anteriorly, converging V-like at base of scutellum, their inner edges marked on the anterior third (where they are evanescent), by lines of diverging black bristles. Scutellum yellow, with admedian black stripes continuing the mesonotal bars leaving only the centre and extreme edges yellow. An apical pair of strong, divergent, black bristles. Shoulders and lateral margins of mesonotum with black bristles, a very strong one on each hind corner. Pleura: pteropleuron yellow, meso- sterno- and hypo-pleura black with grey shimmer. Metanotum black with vertical yellow bars descending from lateral corners of scutellum for some distance.

Abdomen: dorsum very dark brownish to black. Base and extreme hind margin of first segment pale; fourth, except for anterior margin broadly, and seventh segments yellowish white. Laterally the abdomen is pale yellowish white on all segments except the sixth, but on second, third and fifth the dorsal black descends to ventral margin on fore and hind edges, the upper margins of the white areas being evenly arched. Venter yellowish white, as are also the small genital lamellæ.

Legs: pale, tibiæ somewhat and tarsi greatly blackened. Tips of hind femora obscurely darkened. A black bristle just beyond base of hind coxæ on the outer side.

Wings: slightly greyish hyaline; third vein running very close to first, and absolutely straight; fifth forked far beyond fourth. Halteres white.

Long 2·75 mm.

Described from a unique female in perfect condition, taken on window, Suduganga, Matale, Ceylon, on 26th September 1921. In my own collection.

EXECHIA BREVICORNIS, sp. nov.

♂. *Head* black, frons with pale pubescence. Lateral ocelli golden, prominent. Some bristles around eye margins, eyes minutely pale pubescent. Antennæ short, not as long as head and thorax; scape and first flagellar joint yellow, remainder greyish brown with pale pubescence.

Thorax dark brown with pale front and lateral margins, bristly at sides and above shoulders, and with a single, strong, postalar bristle. An indistinct V-shaped yellowish brown marking medianly, only visible when viewed from in front. Scutellum dark brown with a pair of long, divergent, apical bristles. Metanotum dark brown; pleuræ brown, propleuron and upper half of pteropleuron yellower.

Abdomen black, laterally compressed. All segments dorsally and laterally very narrowly edged yellow on posterior margins. Genitalia not swollen, yellow. Beyond the side pieces are an elongate pair of narrow rod-like processes, blackish, with two strong black spines at the tip of each, arising from middle of lateral margin; below them are two shorter, narrower processes, also with black hairs, and a pair of ventral processes nearly hidden in strong bristles.

Legs yellow, tibiæ and tarsi darkened, as are also the tips of posterior coxæ.

Wings greyish. Halteres pale yellow.

Long 3·5 mm.

Described from a unique male in good condition, taken in pinewoods, Shillong, on 9th October 1920.

Type in my own collection.

This species is superficially very similar to *E. longicornis*, but the elongate antennæ and very different genitalia will at once serve to separate the males.

The females of both, unfortunately, remain unknown.

EXECHIA LONGICORNIS, sp. nov.

♂. *Head:* frons black, with silvery pubescence, the prominent lateral ocelli yellow. Face yellowish. Eyes very minutely pale pubescent. Some bristles on frons along eye margins, and a median pair, divergent, above root of antennæ. Antennæ considerably elongated, longer than head and thorax, about as long as mid tibia. Scape yellow, both joints with apex above and below with black bristles. Flagellum with basal half of first and extreme base of next two joints yellow, remainder greyish brown, the apical joint half as long again as the penultimate. Palpi yellow.

Thorax dark brown with sparce pale pubescence and black bristles on anterior and lateral margins, above shoulders, and postalar. The brown area is outlined by a pale margin along lateral margins of dorsum, whitish grey above the shoulders and more yellowish behind the wing roots. A medisn pair of ill-defined pale lines, converging V-like to root of scutellum, which is concolorous, with an apical pair of strong, divergent, bristles. Pleuræ brownish grey, propleuron and upper half of ptero-pleuron yellower, the former with several bristles as usual. Metanotum dark with paler lateral margins.

Abdomen strongly laterally compressed, black, with pale pubescence. The hind margins of the first and second segments and the anterior margin of the third, yellow, very narrowly so dorsally. Second and third segments all yellow ventrally. Remaining segments with traces of pale lateral margins. Genitalia, swollen, hairy, dark yellowish, apparently consisting of large yellow side pieces between which can be seen from above a pair of white laminæ, their inner margins only slightly separated, their outer curved strongly, their tips incurved to meet one another, so that the whole appears as a single cordiform plate with a dark median depression not reaching the extreme tip. From the middle of the side pieces, and, more closely approximated, from near their lower margins, extend posteriorly the tips of elongate processes, all with black hairs apically.

Legs yellow, tibiæ and tarsi, also extreme tips of hind femora, darkened.

Wings yellowish grey, halteres pale yellow.

Long 3·25 mm.

Described from a unique male in good condition, taken in deep shade, Shillong, on 15th October 1920.

Type in my own collection.

Exechia flava, sp. nov.

♂. *Head* yellow. Frons with a row of black bristles around eye margins, and above base of antennæ. Face slightly greyish tinged. Eyes minutely pale pubescent, palpi and antennæ yellow, the scapal joints of the latter with black bristles, the flagellar joints very slightly darkened on apical half. Antennæ erect, not porrect as usual.

Thorax all yellow, the median dorsal area slightly browner, the sides above the shoulders, whitish viewed from above. Strong bristles on front and side margins, and in postalar region. Scutellum yellow, crossed subbasally by a dark bar, with a pair of long, crossed, apical bristles, in front of which is a similar, much smaller pair. Metanotum concolorous, with a pair of vertical brown bars admedianly, very narrowly separated Pleuræ yellow.

Abdomen not laterally compressed, yellowish, with black hairs; the junctions of the second to sixth segments indefinitely darkened, with, on second and third, traces of a dark median line connecting the darkened areas at front and back margins of the segments. Hind margin of sixth segment not darkened, concolorous with genitalia. First segment with a well defined yellowish-white bar on hind margin. Genitalia brighter yellow. A pair of thin processes arising from above and below on each side meet beyond the side pieces, the lower pair, which are innermost, with a long, black, spine-like bristle at their tips. A median ventral plate, above which is a median upward directed thorn-like organ, can be seen from above between the four processes beyond the end of the side pieces.

Legs yellow, tibiæ slightly and tarsi greatly darkened. Hind femora basally darkened along upper and lower edges.

Wings very yellowish. Halteres pale yellow.

Long 5 mm.

Described from a unique male in good condition, from Cherrapunji, on 18th October 1920.

Type in my own collection.

This species is very close to *E. basilinea*, Brun., from which it differs by the barely darkened apical part of the flagellum, the uncompressed abdomen, with much less definite markings, and the darkening at the base of the hind femora. The genitalia appear different, as the long spine at the tip of the lower processes is not mentioned in Brunetti's description of his species, though it is very conspicuous. Similarly I have not been able to distinguish the lemon-yellow palp-like appendages in the place of the dorsal plate, to which Brunetti refers. Descriptions of unmounted genitalia, however, are very unsafe things to go by.

Exechia mirastoma, sp. nov. (Plate XV, fig. 11.)

♂. *Head* black, with pale pubescence on frons. Face very narrow, somewhat yellowish medianly. Eyes minutely pale pubescent. Palpi yellow, apical joint brown. Mouth parts prolonged, apparently consisting of a membranous plate, strengthened with two parellel bars of yellow chitin, and bounded exteriorly by a pair of yellow, elongate, acuminate organs (like *Tabanus* palpi), with their apices crossed. Antennæ much shorter than head and thorax, scape and first flagellar joint yellow, remainder greyish brown with pale pubescence.

Thorax dorsum yellow-brown with median paler V-shaped area and whitish lateral margins, only visible when viewed from above. A small dark

area just above wing roots, behind which is a yellow marginal area containing a long postalar bristle. Front and lateral margins bristly, and along each side of central V-mark nearly as far back as the level of the wing roots, but these do not form a dorsal crest, but are directed to lateral, overhanging the steep slope of the thorax on each side. Scutellum dark brown with an apical pair of divergent bristles. Metanotum brown, pleuræ brownish.

Abdomen laterally compressed, black. Hind margin of first segment laterally very narrowly pale, venter of second, third and fourth segments all yellow, but without pale lateral posterior bands above. Genitalia yellow small, beyond the side pieces the almost filiform processes more or less concealed in a tuft of black bristles.

Legs yellow, tibiæ and tarsi darkened.

Wings greyish. Halteres yellow, with black clubs.

Long 2·75 mm.

Described from a unique male in good condition, taken in the pinewoods, Shillong, on 9th October 1920.

Type in my own collection.

It is much to be hoped that further specimens of this species will come to hand, to enable the extraordinary structure of the mouthparts to be properly made out.

Exechia paramirastoma, sp. nov.

♂. *Head* frons yellowish grey, with black hairs; a row of short black bristles above the antennæ, below which the colour is more yellow; face yellow. Palpi short, first joint yellow, remainder brown. Proboscis yellow, apparently similar in structure to *E. mirastoma*, sp. nov. Antennæ with scape and base of first flagellar joint yellow, remainder brownish grey with minute white pubescence. Lower edge of first scapal joint noticeably black bristled. Eyes practically bare, the pubescence extremely minute, pale.

Thorax dorsum very dark brown, the anterior margin narrowly paler owing to a little silvery pile, and the supra-alar region yellowish. There are traces of a median paler V-mark anteriorly, along which are a few irregularly placed black bristles. All the dorsum with short black hairs. The anterior margin bristly, as are also the lateral margins, especially towards the wing roots, and with several strong alar bristles. An acrostichal prescutellar pair, golden brown in colour. Pleura pale whitish, pro-, meso- and meta-pleura brown, the last with a vertical row of three strong bristles. propleuron with two sets of bristles, the upper, smaller set variously directed, the lower, three or four in number, declinate. Scutellum black, with a pale margin

viewed from below, with an apical, very strong, erect pair of black bristles, between which there passes a much smaller, subapical, porrect pair. Metanotum yellow, with median black bar nearly as broad as the scutellum.

Abdomen strongly laterally compressed. The first six segments all black on dorsum, except for a narrow pale apical ring to first segment. Venter yellow; laterally the dorsal black extends to venter on hind margins, but basally the yellow of the venter reaches about half way up the sides, making triangular yellow patches, except on first segment which has only the midline of the venter yellow, all the side being black. Seventh segment, except for extreme base, and genitalia brown, the lower edge of the former extending beneath the latter, its concave posterior margin with strong bristles.

Legs: coxæ yellow, femora concolorous, with dark hairs, tibiæ darkened and tarsi blackened. Fore trochanters with an elongate cuneiform black fleck on upper side.

Wings grey, fork of fifth vein practically immediately below the origin of the third vein. Halteres with pale stem and capitella darkened.

Long 3·25 mm.

Described from a unique male, in perfect condition, taken on window, Suduganga, Matale, Ceylon, on 4th November 1921. In my own collection.

MYCETOPHILA KHASIENSIS, sp. nov.

♀. *Head* pale brown with fine black pubescence, rather longer on the frons and vertex than on the face, which is slightly convex. Eyes minutely pale pubescent. Antennæ yellowish brown, the scape slightly paler, the flagellum with minute whitish pubescence. Palpi yellow, fourth joint straight and very little longer than the third.

Thorax brownish yellow with short golden pubescence and black hairs. Anterior and lateral margins, especially in front of wing roots, humeri and postalar region, bristly, a prescutellar dorso-central pair. Scutellum concolorous, with four marginal, parallel, bristles. Metanotum and pleuræ rather paler brownish yellow.

Abdomen yellow-brown, strongly compressed, the dorsum darkened, with pale hind margins narrowly to the segments dorsally and laterally. Ovipositor flattened, ensiform, the lower margin evenly curved to the very slightly erected tip, the upper margin broadened on basal third to a shoulder, whence it is evenly curved to tip. In the notch of the shoulder the slightly darker yellow, black haired lamellæ are situate.

Legs yellow, tibiæ and tarsi somewhat darkened. The inside range of setæ of mid tibiæ much shorter than the two outer ranges, of five bristles, the

lowest much the longest, and all crowded towards the middle of the joint. Inner range of hind tibiæ also much shorter than the two outer ranges, but the differences in size between the individual bristles is not so marked—(though the lowest is again the longest)—and the range extends over the apical three-quarters of the joint.

Wings and halteres yellow.

Long 4·5 mm.

Described from a unique female in good condition, taken on a window, Shillong, on 11th October 1920.

Type in my own collection.

In Brunetti's key to the genus in " Fauna India, Nematocera " this species divides from his *cinctiventris* on the unicolorous thorax.

PSYCHODIDÆ.

Pericoma metatarsalis (Brun.) var. *khasiensis* (nov. var.) (Plate XV, figs. 2, 3, 4.)

♂ ♀ . *Head* black, covered with white scale-like hairs, a fan of which overhangs the mouth parts, which appear to be formed for biting. Antennæ pale brown with white hairs, 2+14 jointed, the scapal joints wider than the flagellar, the first short, the second globose ; flagellar joints, the first shorter than the next ten, the next two about as long as the first, the apical rather longer than any other. Palpi five jointed, the first three joints stout and long, the two apical thinner and shorter, subequal.

Thorax black, thickly clothed with erect white scales, those on the posterior half of the dorsum of a dirty white, with their tips darkened. A very strong tuft arises from the postalar calli. Scutellum similarly clothed.

Abdomen black, with erect white thread-like scales. Male genitalia dark brown, more or less concealed amid white hairs in unrubbed specimens, the lamellæ at the tip of the inferior claspers brownish yellow. Female ovipositor yellow-brown, laterally compressed, slightly down-curved, prominent.

Legs dark brownish (the female femora paler yellowish brown) with scattered white hair-like scales on femora and tibiæ, the latter with their tips ringed by flat white scales. All metatarsi with rather more than the apical half white, the remainder of the tarsi very black. Along the inner side of the metatarsi is a narrow black area running through the white, so that, viewed from certain positions, the metatarsi appear all black. Hind tibiæ with so many white hairs as to appear quite white on basal three-quarters, with some outstanding long white hairs above, a row of stiff dark hairs below towards the middle, and a tuft of such all round the tip.

Wings with divaricate rows of brown hairs along the veins, only slightly overlapping one another. From second to seventh a black spot at the tip of each vein formed of closely approximated hairs. There are erect hair-like scales in tufts as follows :—on petiole of upper branch of second vein (white), at fork of upper branch of second (thick, black), which continues, less densely (black) along each branch, and on the lower branch of the vein immediately below, as far as a point almost below the tip of the first vein, at which point the black gives place to small white spots ; at fork of fourth vein (black), on middle of upper branch of fourth (white), at one-third and two-thirds length of fifth (white), and at two-thirds of seventh (white). Base of wing covered with upstanding grey scales among which are some white ones. Wing fringe black, very dense on costa, and long on hind margin ; the outer half shows white between tips of lower branch of second and third veins at extreme apex. Halteres black.

Long 1·5 mm.

Described from four males and two females taken on leaves of scrub-forming hedges, Mawphlang, Khasia Hills, on 10th October 1920. Type, allo-type and other specimens (one dissected and mounted), in my own collection.

Except the types, none of the specimens are in good condition. The day was wet, cold and dull, and they have suffered in a damp net.

I hesitate to make a new species of these specimens, as they accord well with Brunetti's description, save that he states that the fringe of the wing at the tip is composed wholly of white hairs, whereas in my specimens the fringe is black at the base throughout, and only the outer half of the hairs are white.

Further, the white section is much shorter than Brunetti describes. The description of *metatarsalis* is a differential one,—so I have described my variety at length,—as it may prove a good species, when males of *metatarsalis* come to hand, and it becomes possible to examine the male genitalia.

Simuliidæ.

On the Indian species of the genus Simulium, Latreille.

Since 1911, when Brunetti described seven species, all from the Himalaya and Assam Hills, with two of the species extending to the Western Ghats in North Kanara, nothing further has been done in the study of the Indian forms. The same author, in the following year, added a very distinct species from Ceylon, the distribution of which was later extended to the Palni Hills of the extreme South of the Peninsula by Patton and Cragg, who included it in their table of Indian species, Brunetti having described it too late for inclusion

in his table in the 'Fauna of India.' Although Patton and Cragg appear to have bred the species they say nothing about the male which, if I am right, is very different to the female. Five out of seven of Brunetti's species are described from examples of one sex only, and regarding two of them, he considers that they possibly represent alternative sexes of a single species. As other species, when their alternative sex is discovered, may also show sexual differences, in the table now offered I have indicated the sex of the species indicated. The male of *striatum*, described herewith, I take to be that species, as I have found it in company with undoubted females though not actually *in cop.*, which alone can settle the matter. *S. striatum* is the only species hitherto recorded from Ceylon, although I take this opportunity of recording the capture of a male *grisescens*, hitherto only known from a unique male from Kurseong, on a window at Suduganga, Matale District, on 13th January 1920, which affords yet another instance of that close relationship which exists between the dipterous fauna of the Island and the Eastern Himalaya.

Except for Patton and Cragg's record, the *Simuliidæ* of the Madras Presidency have remained quite unknown, but three species are now described. I have not seen examples of *striatum* from the Palnis, and such may form an annectent link between *striatum* of Ceylon and *latistriatum* from the Nilgiris, which, although their descriptions read much alike, appear perfectly distinct when the two species are placed side by side.

KEY TO THE INDIAN SPECIES OF *SIMULIUM*.

(Based on Brunetti's key in 'Fauna of India.')

1. Thorax unstriped .. .. 2.
   Thorax striped .. .. 12.
2. Thorax black, at most with dull reddish brown tinge .. .. 3.
   Thorax distinctly reddish brown, with short yellow hair .. *rufithorax*, Brun. ♂ ♀
3. Thorax with grey shoulder spots and a wide greyish band on posterior margin .. .. *grisescens*, Brun. ♂
   Thorax without definite shoulder spots ,and with no posterior band .. .. 4.
4. Abdomen destitute of any signs of yellow hair .. .. 5.
   Abdomen with short bright yellow hair, or with rather long brownish yellow shaggy hair .. .. .. 10.
5. Hind metatarsus much incrassated, nearly as long and as large as its tibia .. .. *metatarsale*, Brun. ♂
   Hind metatarsus not so conspicuously incrassated, distinctly less in size than its tibia .. .. 6.
6. Antennæ wholly black. Length 2·5 mm. .. .. *griseifrons*, Brun. ♀
   Antennæ reddish yellow at base. Smaller species .. 7.

7.	Femora black	8.
	Femora yellow or pale brown	9.
8.	Fore tibiæ whitish yellow	*rufibasis*, Brun. ♀
	Fore tibiæ black	*pattoni*, sp. nov. ♀
9.	Mid femora dark	*striatum*, Brun. ♂
	Mid femora yellow	*gurneyæ*. sp. nov. ♀
10.	Abdomen with normal, short, very bright yellow hair ..	11.
	Abdomen with distinctly longer, shaggy, brownish yellow hair .	*senile*, Brun. ♂
11.	Abdomen with at least the first two segments distinctly yellowish or brownish yellow; often several segments so coloured	*indicum*, Becher. ♂ ♀
	Abdomen all black	*aureohirtum*, Brun. ♂ ♀
12.	Admedian grey stripes much wider than the acrostichal black stripes	*striatum*, Brun. ♀
	Admedian grey stripes hardly as wide as the acrosctichal black stripes	*latistriatum*, sp. nov. ♀

Simulium striatum, Brunetti.

♂. *Head* black, face with pale brassy pubescence. Antennæ stout, reddish-brown, with pale pubescence, appearing almost yellow in some lights, in others darker, but never black, and always unicolorous from base to tip. Proboscis and palpi brown, a little darker than the antennæ, the basal joint of the palpi not incrassate.

Thorax black, the dorsum covered with bright brassy golden hairs, usually more or less denuded on middle third, with no traces of the female stripes. Pleuræ dark grey, with ashy grey reflections, and sometimes a tinge of brown on humeri and sternopleura. Scutellum black, with brassy golden hairs and some apical black bristly ones. Metanotum black, with minute brassy pile.

Abdomen black, with some microscopic pale hairs on dorsum, but no golden ones, the basal hair fans brown. Genitalia concealed.

Legs: fore coxæ yellow, with pale hairs, trochanters darker, also with pale hairs, femora and tibiæ pale brown, tarsi blackish. Posterior coxæ dark (except apex of mid pair, pale), trochanters pale. Mid femora dark except extreme tip tibiæ dark brown with pale base, tarsi blackish. Hind femora brown, tibia incrassate, as large as femur, with base pale, otherwise concolorous. Metatarsi with basal half pale and apical dark, second joint pale at base, remainder black, third and fifth joints black, fourth pale with a black line across the middle. Hind metatarsus as long as tibia—but half its width.

Wings normal, with veins yellow. Halteres golden brown.

Long 1·5 to 2 mm.

Described from 8 males all in good condition, taken on windows, Suduganga, Matale, Ceylon, as follows :—three on 28th December 1919, in company with 3 females ; on 18th, 22nd, and 23rd January 1920 ; and 20th March 1920. All in my own collection.

Simulium latistriatum, sp. nov.

♀ *Head* dark grey, face more ashy grey. Frons triangular. Antennæ with scape yellowish, flagellum very dark brown, with pale pubescence. Palp black, basal joint hardly thickened. Proboscis brown.

Thorax ash grey, with pale silvery hairs. Five black stripes, broader than in *S. striatum*, median, acrostichal, and subdorsal, the outer pair on each side joined along the fore margin, and thus the grey ground colour only reaching the fore margin each side of the median stripe, which hardly reaches the margin. All stripes stopping just before the level of the wing roots, and the acrostichal pair slightly convergent anteriorly. The posterior quarter of the dorsum is all black viewed from a low angle in front, and all grey from an equal angle behind. Pleuræ dark brownish grey, scutellum concolorous, hind margin on underside a little brownish. Metanotum dull black. Scutellum denuded, probably in life with the pale pubescence of the thoracic dorsum.

Abdomen black, the latera lbasal hair fans pale.

Legs : fore coxæ yellow, posterior pairs blackish ; all trochanters and femora yellow ; all tibiæ yellow with black tips. Fore tarsi all black, the first three joints enlarged. Mid metatarsus and second joint whitish with black tips, third and fourth joints more or less brown, fifth black. Hind metatarsus two-thirds as long as tibia, and half its width, whitish with black tip, second joint similar, in colour third to fifth brownish.

Wings normal, veins very pale yellow-white. Halteres bright yellow.

Long 1·25 mm.

Described from two females in good condition, biting bull, Coonoor, 25th September 1920, at dusk. Type and co-type in my own collection.

Simulium pattoni, sp. nov.

♀ . *Head* black, frons and face ash grey with silvery hairs. Occipital margins laterally with pale hairs. Antennæ, scape and first flagellar joint yellow, remainder dark brown. Palpi black, basal joint thickened, but not as long as the second. Proboscis reddish brown.

Thorax: dorsum and scutellum black, covered with bright golden hairs, the latter with black marginal hairs also. Pleura dark grey with ashy reflections; propleuron with a tuft of white hairs.

Abdomen black, with scattered very short pale hairs; lateral basal hair fans pale.

Legs fore coxæ yellow-brown, posterior pairs black. All trochanters and femora black. Fore tibiæ and tarsi black, the former with some short golden hairs on the sides, the latter with the first three joints enlarged, Posterior tibiæ black with whitish bases. Mid tarsi very dark brownish, basal half of metatarsus pale, fourth joint obcordate, the two lobes pale. Hind tarsus with basal half or two-thirds of meta,—extreme base of second and lobes of the obcordate fourth joint, pale, remainder black.

Wings normal, veins pale yellow. Halteres bright yellow.

Long 1·5 to 2 mm.

Described from five specimens, all taken on bull at dusk, Coonoor, on 25th September 1920. Type and others, some in indifferent condition, in my own collection. I have much pleasure in dedicating this species to Major W. S. Patton, I.M.S., at that time Director of the Pasteur Institute of Southern India, in grateful acknowledgment of many pleasant hours spent in his laboratories.

Simulium gurneyæ, sp. nov.

♀. *Head* dark grey, face shining whitish grey. Antennæ with scape and two basal flagellar joints yellowish brown, remainder blackish brown. Palpi black basal joint long, thickened. Proboscis black with brown labella.

Thorax dorsum black with indefinite ashy reflections above the fore corners, and rather sparce brassy hairs, scutellum concolorous, with long black hairs on hind margin. Pleura ash grey.

Abdomen black, dorsum with scattered pale pubescence, lateral basal hair fans pale golden. Base of venter yellow or brownish.

Legs: fore coxæ yellow, posterior pairs dark. All trochanters and femora yellow, tibiæ yellow with black tips. Fore femora almost white in certain lights. Fore tarsi all black, the first three joints greatly enlarged. Mid metatarsus yellow with apex darkened, second joint with extreme base pale, remainder and third and fourth joints dark brown, fifth black. Fourth joint obcordate. Hind metatarsus as long as tibia, and a little more than half its width, pale, with black tip, second joint with basal half pale, remainder, and third or fifth joints, black.

Wings normal, veins pale yellow. Halteres bright yellow.

Long 2 to 2·5 mm.

Described from fourteen specimens, some in good, some in indifferent condition, taken on bull at dusk, Coonoor, 25th September 1920. Type, and other specimens in my own collection.

I have much pleasure in dedicating this species to Mrs. W. S. Patton, well known, in collaboration with her husband, in the study of Indian blood-sucking Diptera.

TIPULIDÆ.

Dicranomyia nitidithorax, sp. nov.

♀ *Head:* occiput and vertex brownish black, frons black with silvery pubescence, a full third of the width of the head, not narrowed below, very long, so that the antennæ practically touch the base of the blackish proboscis, with which the palpi are concolorous. Antennæ, first scapal joint yellow, second globose, wider than the first, black; flagellum black, joints well defined, the acuminate apical twice as long as the penultimate, elongate flask-shaped, the whole antenna clearly fourteen jointed.

Thorax: dorsum deep shining very dark brownish black, unmarked, rather highly arched, with presutural dorso-central rows of hairs. Humeri pale yellowish. Scutellum and metanotum concolorous with mesonotum and equally shining. Pleura concolorous, with shimmery white pubescence only visible in certain lights.

Abdomen somewhat shining. Under a low power it appears brown, the apices of the segments yellow banded; under a high power the first six segments show yellow, semi-transparent, the dark organs showing through, the brown coloration not being visible; seventh segment dark brown, eighth black with median transverse grey band. Ovipositor dark brown with short yellow valves. Venter, first seven segments brownish yellow, the segmental junctions, very narrowly darkened, eighth segment blackish.

Legs: coxæ and trochanters and bases of femora yellow, the latter gradually darkening to brown, tibiæ brown, tarsi blackened. (Hind legs missing beyond trochanters.)

Wings uniformly grey, iridescent, stigma distinct but its margins ill defined. Tip of auxiliary vein exactly in line with base of prefurca, the fork of which is just before the tip of the first vein, being thus much shorter than the second vein itself. Basal section of third vein four times as long as the anterior cross vein, which is situate at the upper basal angle of the discal cell, which itself is nearly as long as the second or third posterior cells. Submarginal cell considerably longer than the first posterior. Posterior cross-vein

slightly proximad of the base of the discal cell. Halteres yellow with capitella black.

Long 35 mm.

Described from a unique female in fair condition (legs damaged), taken at Shillong, on 14th October 1920. In my own collection.

The very wide frons and general facies show that this species is allied to Brunetti's *nigrithorax*, but against its being the female of that species are the yellow first scapal joint, shorter prefurca, normal number of antennal joints, absence of gold dusting on thorax, and yellow coxæ.

Libnotes. (*Westwood.*)

In his key to the Indian species of this genus in the '*Fauna*' Brunetti omitted two Indian species, as he notes in his '*Catalogue of Oriental Nemocera.*' In adding two new species from Ceylon, I herewith offer an amended table of the Indian forms.

1.	Wings unmarked,—(except for stigma, present or absent) ..	2.
	Wings more or less conspicuously patterned	3.
2.	Body bright orange red	*thwaitesiana*, Westw.
	Body yellow-brown, abdomen banded	*immaculipennis*, sp. nov.
3.	A cross-vein in submarginal cell	*fuscinervis*, Brun.
	No cross-vein in submarginal cell	4.
4.	Marginal cross-vein nearly twice its own length before tip of first vein	*poeciloptera*, O. S.
	Marginal cross-vein at most its own length distant from tip of first vein	5.
5.	Surface of wing with large spots crossing from vein to vein ..	*notatinervis*, Brun.
	Surface of wing with practically only the veins patterned ..	6.
6.	Scape, proboscis and palpi yellow	*distincta*, sp. nov.
	Scape, proboscis and palpi blackish	7.
7.	Second and third veins absolutely unmarked beyond base ..	*notata*, v. d. Wulp.
	Second and third veins narrowly spotted along their courses ..	*punctipennis*, Meij.

Libnotes immaculipennis, sp. nov.

♂ ♀. *Head* grey, occiput with longish black hairs; frons very narrow, whitish. Antennæ, scape pale brown, with apices of both joints (the first broadly), yellow; flagellum darker brown, basal joints nearly twice as long as broad, the apical narrow, elongate the last not much longer than the penultimate. Hairs of flagellum not much longer than the individual joints. Proboscis and palpi brown.

Thorax yellow: a brownish stripe occupying the whole dorsal surface of the neck and running to suture—(in female more reddish brown posteriorly)—

postsutural calli with large brown spots, median area and scutellum pale yellowish. Dorso-central rows of black hairs on both portions of mesonotum. Metanotum brownish yellow. Pleura yellow, unmarked.

Abdomen brown, apices of segments yellow banded, more distinctly so in female. Venter yellowish. Male genitalia yellow, claspers blunt, black tipped. Ovipositor reddish yellow.

Legs: coxæ, trochanters and tips of femora yellow, remainder of femora tibiæ first two tarsal joints wholly, and basal half of third, brownish yellow tip of third and last two tarsal joints blackish.

Wings, except for a fairly well defined brownish stigma, clear, absolutely without markings on veins or membrane: not as elongate as in the remainder of the Indian species. First vein ending free, joined to costa by an indistinct branch at right angles, *proximad* its own length of the subcostal cross-vein, the true vein, which is marked by the line of short hairs on it, continuing to margin of stigma. Posterior cross-vein beyond middle of discal cell. Halteres yellow, capitella blackened.

Long 5 mm.

Described from a pair, the female taken on 15th December 1918, the male on 19th November 1919, both at Suduganga, Matale, Ceylon. In my own collection.

LIBNOTES DISTINCTA, sp. nov. (Plate XIV, fig. 3.)

♂. *Head* yellow, frons almost pinched out above, triangular below; face greyish-yellow. Proboscis whitish yellow, palpi deeper yellow. Antennæ, scape yellow, flagellum very pale grey-brown, the basal joints nearly as broad as long, the apical joint twice as long as the penultimate, the hairs on the joints slightly longer than the joints themselves. Vertex elevated above eye margins, occiput with long yellow hairs.

Thorax yellow, mesonotum with front and side margins slightly brownish. From fore margin a concolorous stripe, which at one-third of the distance to the suture separates into two admedian stripes, which do not quite reach the suture. At half the distance from fore margin to suture commence a pair of subdorsal concolorous stripes, slightly darkened posteriorly, which cross the suture and become indefinite spots on postsutural calli, the middle depression pale whitish-yellow, scutellum concolorous. Pleura pale whitish yellow, notopleural suture darkened below the dorso-marginal brown band, a dark brown stripe starting on neck, passing above base of front coxæ to middle of pteropleuron, on front half of which it is ill defined. An interrupted brown stripe across middle of front coxa, sternopleuron, bases of posterior coxæ to a

spot on hypopleuron. A brown spot at middle of front side of mid coxa. Metanotum yellow, brownish at sides, with a small black spot below the corners of the scutellum.

Abdomen yellow with dark brown lateral stripes. Genitalia yellow.

Legs yellow, femora with a brown subapical ring, tips of tibiæ and first three tarsal joints slightly infuscated, last two tarsal joints blackened. Ungues with a strong tooth some distance beyond base.

Wings with numerous short black lengths on the otherwise pale yellow veins, around which are often almost imperceptibly faint infuscations. Marginal cross-vein nearly its own length before tip of first vein. Halteres stem yellow, capitella brown.

Long 6 mm.

Described from a unique male in good condition, taken at light, Suduganga, Matale, Ceylon, on 27th November 1919. In my own collection.

RHIPIDIA ZEYLANICA, sp. nov. (Plate XIII, figs. 2, 5.)

♂. *Head:* frons varying in width from that of the two conjoined narrow parafrontalia to one-third that of head, grey. Face concolorous, proboscis and palpi dark grey-brown. Second joint of palpi swollen, more than twice as wide as first joint. First and second joints subequal in length, third and fourth half as long again, subequal, and narrower than first joint. All joints hairy. Antennæ pale brown, first scapal joint twice as long as wide, wider at three-quarters its length than at tip, second vasiform; flagellum, first joint oblate spheroidal, second to ninth cylindrical (except fourth, rather more flask-shaped), tenth and eleventh irregularly rounded, twelfth round with elongate mammiliform apex. The third to eighth joints bear each a pair of finger-like darker brown processes, the second and ninth a single process, less well-formed than on the intervening joints, whilst the tenth and eleventh appear to have rudimentary processes. The processes are pale pubescent, and are longer and rather wider than the joints themselves on third to eighth joints. Occiput grey, with impressed median line and pale hairs.

Thorax brown, with minute pale golden pubescence, the absence of which from certain areas forms darker stripes thus:—a broad median stripe from suture, divided at rather more than half the distance to the anterior margin into three parallel lines, and submedian narrower stripes commencing at the forking point of the median stripe (where they are incurved towards it), and continued across the suture to postalar calli. The forking of the median stripe may not occur, it may continue broad to anterior margin, or the outer lines may disappear at half their length and appear again as spots on the

anterior margin. Pleuræ brown with pale golden pubescence, and a dark, almost black, band along sternopleural suture. Scutellum and metanotum concolorous with dorsum of thorax, the former with median darker stripe, and sometimes traces of the submedian thoracic stripes exterior to this.

Abdomen brown, with pale hairs, darkened to black at the junctions of the segments, and with a black lateral line. Genitalia bright yellowish-brown, apparently consisting of two large, subequal, fleshy joints, from inner basal sides of second of which arise a pair of re-curved brown hooks, bearing each on their upper sides at half their length an upward and backward directed spine, apically bifid. Below the large claspers is an unpaired stout median thorn-like process, its tip slightly down-curved.

Legs dull yellow, the femora subapically, the tibiæ and tarsi apically and very narrowly, very slightly darkened,—not always apparent,—(absent in type).

Wings grey, with very numerous slightly darker spots, noticeably on midcosta, over tip of auxiliary and first veins, at base of prefurca and third veins, and over the cross-veins. Veins yellow, the costal black at tip of auxiliary, first and second, the first above base of fourth, through the midcostal spot and at base of prefurca, the fifth, sixth and seventh with several small black lengths. Seventh veins somewhat sinuate. Halteres yellow.

Length: body 4 to 6 mm., wing 6 mm.

Described from four males, two in fair and two in bad condition, three taken at Emelina Estate, Maskeliya District, Ceylon (4,200 feet), on 12th, 13th January 1919, and one at Maskeliya Town, on 26th January 1919 (*G. D. Austin*). Type and other specimens in my own collection.

This species differs from Brunetti's *R. antennatus* (from Simla), by the dichoptic head and the different structure of the antennæ, the development of the flagellar processes extending to all joints in his species.

In the figure of the antennæ on Plate XIII the first flagellar joint is shown somewhat too small. It should be nearly as broad as the second scapal, and nearly half its length.

ERIOPTERA INCOMPLETA, sp. nov. (Plate XIV, fig. 11.)

♂. *Head* yellow grey, frons broad, one-third width of head, occiput with black hairs. Face concolorous, proboscis and palpi brownish. Antennæ; scape brown, the first joint somewhat grey dusted, about three times as long as broad, the second cupuliform, much broader than the first; flagellum, first joint yellow with the extreme tip brown, remainder brown, the first four or five joints rounded, closely sessile, gradually lessening in diameter, so that this part of the flagellum appears under a low power elongate conical, remaining

joints elongate, thin,—all joints from fourth onwards with verticals of a few hairs, the longest of which exceed the length of the first scapal joint.

Thorax grey, presutural dorsum with the usual four stripes, the outer pair not commencing until half length, in front of which there is on each side a small pit-like depression, appearing very dark. Humeri narrowly brownish. Post-sutural dorsum with the usual two dark spots, confluent medianly, the sides above wing roots pale grey, as are also scutellum and metanotum. Pleura brownish with grey dusting.

Abdomen reddish brown, basal and apical joints darker. Bases of third and subsequent segments narrowly yellow banded. Venter similar. Genitalia brown, paler than the last abdominal segment.

Legs : coxæ brown with grey dusting, remainder yellowish brown.

Wings smoky yellow brown, with a large dark fuscous spot around marginal cross-vein with a narrow costal band, nearly as dark, in the first submarginal cell. Subcostal cross-vein apparently at tip of auxiliary, marginal cross-vein near tip of first vein, ending below at bifurcation of second vein, or just on extreme base of its upper branch, which gradually fades out, not clearly reaching the costa. Posterior cross-vein just beyond the fork of the fourth vein. Fifth, sixth and seventh veins not approximated. Costa with longish hairs, those on veins not at all conspicuous. Halteres yellow ; capitella brown.

Long 4 mm. Wing 6 mm.

Described from a unique male in good condition, taken on *Lantana* scrub along river bank, Suduganga, Matale, Ceylon, on 5th July 1920. In my own collection. In Brunetti's table of Indian species this runs to couplet 2 and separates there on position of posterior cross-vein.

ACYPHONA INDICA, sp. nov. (Plate XV, fig. 7.)

♂ *Head* yellowish grey, frons narrow, with a median dark stripe. Face whitish grey. Antennæ yellow, apical half darkened, the whole flagellum with thick white pubescence. Palpi black. The antennæ if bent back would reach the wing roots.

Thorax reddish brown ; pronotum, anterior margin of mesonotum (except a narrow median stripe), and a short line extending forwards at the side of the dorsum from the suture, yellowish grey. A pair of admedian nearly black stripes, not reaching anterior margin and stopping at the suture, with the dorso-central rows of paler hairs exterior to them, these rows not separating postsuturally, where they are sparcer. Median area of postnotum slightly paler than the dark sides. Postalar calli yellowish. Scutellum very dark brown, metanotum concolorous in middle, sides yellowish. Pleura brownish,

propleuron more yellowish, mostly grey dusted. Pteropleuron with a fan of longish, soft golden hairs below wing roots.

Abdomen blackish, covered with pale yellowish long hairs. Genitalia brown not prominent.

Legs : coxæ and posterior trochanters greyish brown, remainder yellow, with concolorous hairs. Femora with broad subapical dark rings, tips of tarsi darkened.

Wings clear, veins yellow with numerous short black lengths, especially through the pale fuscous spots that are scattered over the wing along their courses. A darker band over the cross-veins. Hairs on veins not very dense, black. Venation typical, fourth posterior cell in one wing with an adventitious, incomplete, additional cross vein. Halteres yellow.

Length : body 5 mm. : wing 6·5 mm .

Described from a unique male in fair condition, taken in bungalow, Shillong, on 6th October 1920. In my own collection.

This is the first species of the genus to be described from the Indian subregion, the other two Oriental species being Malayan, from Java and Sumatra respectively.

GONOMYIA CONJUGENS, sp. nov. (Plate XV, fig. 8.)

♂ ♀. *Head* yellow, frons with a median dark area ; face, proboscis and palpi very dark brownish black. Antennæ, scape and first flagellar joint yellow, basal half of flagellum otherwise, brown, apical half yellowish. In male fourth to sixth flagellar joints with long, apical hairs, two or three to a joint each as long as about half the whole flagellum.

Thorax dark brown, notopleural suture and humeri whitish yellow, postsutural mesonotal depression slightly paler brown than remainder of dorsum. Scutellum yellow with median basal dark brown spot, much larger in male than in female. Metanotum dark brown with pale grey dusting. Pleura dark brown with a broad whitish band from base of fore to base of hind coxæ.

Abdomen black, with all segments except basal—(and that also, faintly, in male)—with yellow bands to hind margins, broader in the male, in which the bands are present, indistinctly, on the venter, which is not the case in the female, which has the venter reddish brown. Male genitalia brown, with three black linear chitinous processes, one directed posteriorly, two laterally. Ovipositor brown.

Legs yellow, all femora with broad dark subapical rings. Tarsi blackened.

Wings clear, with dark spots at tip of auxiliary, below tip of first, and at tips of both branches of second vein. Discal cell closed. Halteres yellow with black capitella.

Long 4 mm.

Described from a male in fair condition, taken in pine woods, Shillong, on 9th October 1920; and a female, in good condition, taken among guinea grass, Suduganga, Matale, Ceylon, on 21st November 1919. Both in my own collection.

The spotted wings and banded abdomen easily distinguish this species from the only other Indian species with closed discal cell.

The species affords another link between the faunas of Ceylon and the Khasia Hills.

AMALOPIS NOVEMPUNCTATA, sp. nov. (Plate XV, fig. 5.)

♂. *Head yellow*, vertex with some longish concolorous and a few shorter darker hairs, frontal protuberance not prominent. Antennæ yellow, apical half of flagellum brownish, the joints after the first ill-defined. Scape hairy, flagellum with short whitish pubescence. Palpi dark brown. Proboscis yellow with tips of labella brown. Eyes apparently bare.

Thorax yellow, a dark ring at junction of head and neck. Prothorax very distinct, nodose, with longish black hairs on the sides of the protuberance. Mesonotum with slight, darker pile, and dorso-central rows of hairs as far as the suture. Around the suture are eight black spots arranged in a rough circle, the anterior pair dorso-central, smaller, the next pair presutural, towards lateral margins, larger, the next of same size, post-sutural and supra-alar, the hind pair large, dorso-central, but considerably before hind margin. In the centre of the circle, on mid line, its anterior edge resting on the suture, is a large black pentagonal spot. A short black streak on each side below the posterior corners. Pleura, scutellum and metanotum yellow, immaculate.

Abdomen yellow, with brown hairs. Second to sixth segments with a median ill-defined dorsal stripe, the lateral margins of second to fourth segments narrowly black, venter yellow, darkening to brown on fourth and subsequent segments, the third to fifth with short sub-basal black streaks submedianly. Genitalia dark yellowish, large, complex, with dark hairs.

Legs yellow. Tips of all femora, tibiæ and first three tarsal joints black, the latter very narrowly. Last two tarsal joints all blackish. Tibial spurs distinct, ungues yellowish.

Wings yellowish, costal, anal and axillary cells nearly clear. A very deep yellow stripe along both sides of first vein, edged blackish below, not reaching

to the fourth vein its lower edge parallel with first vein, with a black spot each side of sub-costal cross-vein, and a black streak over base of profurca. Costal cell with numerous short black transverse flecks, the pattern differing in the two wings ; some black suffusion around tip of auxiliary vein and along costal margin of submarginal cell. Below the tip of auxiliary the yellow colour around the first vein gradually turns brownish, and proceeds as a broad band to apex, its inner edge reaching margin in second posterior cell. This band contains a clear spot in outer half of marginal cell. A brownish suffusion over the cross-veins, with a branch from the base of the second sub-marginal cell to base of second posterior. Fifth vein with a brown streak lying just below it, and a pale brown spot over tip of seventh vein, reaching sixth vein above. Sub-costal cross-vein at one-third length of wing, marginal cross-vein just before tip of first vein, sub-marginal cells equal, discal cell open. Halteres pale yellow.

Long 11 mm.

Described from a unique male in good condition, taken on scrub in shade, Shillong, 9th October 1920. In my own collection.

The only point at variance with the generic definition is the non-pubescent eyes. The pattern of wing and thorax amply distinguishes this beautiful species from all its known Oriental congeners.

Limnophila fletcheri, sp. nov.

♂ ♀ . *Head* grey, vertex somewhat swollen, occiput with a postocular row of longish dark hairs well separated from eye margins behind and with the two rows not meeting on the vertex. Antennæ short in both sexes, pale brownish. Palpi black.

Thorax shining very dark brown, humeri pale yellowish. Prescutum with dorso-central rows of dark hairs. Pleuræ dark brown, grey dusted. Scutellum dark brown, metanotum paler with dark brown lateral margins.

Abdomen black, unmarked, slightly shining, with dark hairs. Male genitalia dark brown, female ovipositor with valves long, yellowish.

Legs : coxæ and trochanters blackish, remainder pale yellow brown, tips of femora and tarsi slightly darkened.

Wings uniformly grey, stigma absent. Subcostal cross-vein at tip of vein First vein ending free, though a line of hairs and a depression in the membrane shows its course to the margin and the position of the absent marginal cross-vein near its tip, half way from tip of prefurca to tip of upper branch of second vein. Prefurca hardly larger than upper branch of second vein. First sub-marginal cell nearly as long as second, which is as long as first posterior. Four

posterior cells. Discal cell as long as second posterior. Anterior cross-vein in line with basal section of third vein, at upper basal angle of discal cell ; posterior cross-vein at nearly half length of latter. Halteres pale, capitella blackened.

Long 4·5 to 5·5 mm.

Described from four males and two females taken as follows :—two males and one female in deep shade, Shillong, 15th October 1920, one male Cherrapunji, 18th October 1920 : a pair *in cop.* (type and allotype), in shade, Shillong, 20th October 1920. All in my own collection. The much longer discal cell sepatesra it from *parvicellula*, Brunetti.

LIMNOPHILA MULTIPUNCTIPENNIS, sp. nov. (Plate XV, fig. 6.)

♀ . *Head* greyish brown, occiput and frons with an indefinite median darker stripe. Antennæ, scapal joints blackish, large, flagellum pale brown with whitish pubescence, very thin, the whole antenna not more than twice as long as head. Palpi blackish.

Thorax bright yellowish brown, prothorax with sides darker and traces of a median dorsal stripe. Mesonotum with well-defined admedian dark brown stripes, which almost meet on the fore margin and run into one another just in front of the suture, where they terminate ; marginal dark brown stripes commencing at half the length of prescutum, and on postscutum broadening out. A very dark triangular median mark on suture. Presuturally dorsocentral rows of short hairs, arising from the middle at the pale stripes. A short brown bar presuturally above the notopleural suture, not visible from above. Pleura pale brown with an indefinite darker stripe from root of fore coxæ parallel to notopleural suture. Scutellum and metanotum dark brown the upper part of latter paler yellowish below the tip of the former.

Abdomen dark reddish to blackish brown, unmarked, anal segment paler. Ovipositor long, base black, tips of valves yellowish.

Legs pale yellow, tips of femora blackened. (Middle legs missing.)

Wings clear with very numerous pale brown spots. Subcostal cross-vein at tip of vein, marginal cross-vein incomplete, not reaching upper branch of second vein, prefurca long, commencing at one-third of the wing, five posterior cells, discal cell about twice as long as broad. Halteres pale brownish yellow.

Long 6·5 mm.

Described from two paratype females neither in good enough condition to be made the ultimate type, taken at Shillong on 2nd October 1920 (at light) and on 6th October 1920, in bungalow. In my own collection.

Very distinct from the hitherto described Oriental species.

RHYPHIDÆ.

OLBIOGASTER ZEYLANICUS,* sp. nov. (Plate XIV, figs. 5, 13.)

Head black, posterior eye margins laterally, sides of frons, lower half of frontal carina, and face, except for a large block median spot, yellow. Occiput and vertex swollen above, with longish hair, black on former, white on latter. Ocelli close together, the mid ocellus much larger than the two upper ones. Frons at widest (at level of antennæ), one-third width of head, somewhat narrowed at level of ocelli, depressed below level of eye margins, the lower half with a median protuberance, across which runs a carina to between roots of antennæ, shining black above, yellow below; remainder of black area of frons grey-dusted. Face, proboscis and palpi with short black hairs, the two latter concolorous with the former. Eye facets all equal. Antennæ as long as the body. Scape dark yellow below, black above, the basal joint rather wider, globose and three times as long as the apical. Flagellar joints black, distinctly paler beneath, with closely set black, bristly pubescence, the inner edges of each joint with very minute microscopic pubescence and about a dozen definite, widely separated, short, spiny bristles, in two or three rows, spaced more or less equidistantly in each row, the rows all close together. First joint about three times as long as broad, the next four times. The remaining twelve joints approximately as long as the second, but gradually and evenly narrowing to apex.

Thorax: neck yellow. Dorsum of thorax shining black with long white hairs. A triangular yellow area, enclosing a small black spot, on fore corners, humeral calli prominent, lobose, black with white hairs, the upper anterior half yellow. Postalar calli yellow. Dorsopleural suture broadly, the propleural and notopleural sutures narrowly, the pteropleuron and spots at base of fore and hind coxæ, yellow: remainder of pleura black. Scutellum and metanotum black, the former with apex broadly yellow.

Abdomen black, first segment broadest posteriorly, with white basal band, the extreme margin, which is produced into small lobes one each side of the metanotum, black, the whole with long white hairs. Second segment narrowest

* What is probably the female of this species has now come to hand. It differs from the male in that the flagellum is all black above and below, whilst the scape is yellow above in one specimen. The abdominal white spots are much smaller and less prominent. The hind tibial spur is double. In one specimen the hind femora are all black, as in the male, but without the pre-apical yellow ring in the other, the outer third is yellow with black tip. Abdominal segments 6 and 7 and the ovipositor are reddish yellow.

The female differs therefore from Edwards' *O. orientalis* by the reddish sixth abdominal segment and the hind femora always blackened at least on basal half.

Two females, Suduganga, Ceylon, on 12th March and 6th May 1922. In my own collection

apically, with white basal lateral spots. Third to fifth segments with parallel sides, as wide as tip of second segment, with basal lateral white spots, almost confluent medianly on third, entirely so on fourth, widely separated on fifth segment. Sixth and seventh segments swollen, laterally compressed, black except for the apical margin of latter, which is dull brownish. Laterally the second to fourth segments white, as are also the ventral bases of third and fourth segments, remainder of venter black. Abdomen beyond first segment with short hairs, white and black intermingled. Genitalia extremely assymetrical, twisted so that the whole apparatus faces the right side of the insect, the superior claspers white, the lower brownish yellow, the whole covered with white hairs.

Legs : fore coxæ and trochanters yellow, the former with base black. Posterior coxæ and trochanters black, the former of equal length in mid and hind pairs, and with dull whitish depressed areas on mid pair laterally and hind pair latero-posteriorly. Front femora all yellow, mid yellow with basal third blackish, hind all black except a brownish-yellow subapical ring, the extreme tip black. Anterior tibiæ and all tarsi pale whitish, appearing dark owing to closely set setulæ, fore tibia no longer than its femur and shorter than the metatarsus, with a single apical yellow spur. Mid tibiæ with apical spurs double. Hind tibia yellow, its tip black with a single apical spur.

Wings greyish hyaline, the apical third almost imperceptibly darker. Stigma black, a long dark streak through anterior cross-vein, and some suffusion over apex of discal cell. Venation as described by Edwards for *O. sackeni*, but the lower branch of fifth vein practically straight. Halteres pale whitish, the anterior margin of the shaft with a fan of bristles basally, and shorter, more widely set bristles exteriorly. A line of very short bristles on capitellum, not terminating at the tip.

Long (without antennæ), 8 mm.

Described from a unique male in good condition (one antenna and one foreleg damaged), taken on window, Suduganga, Matale, Ceylon, on 10th August 1921. Type in my own collection.

Whilst it is possible that this is the male of *O. orientalis* (Edw.), there are so many points of difference, especially in leg coloration, that I feel justified in describing it as new. It is twenty-four years since the still unique type of *O. orientalis* was taken ; and in several years collecting in this bungalow the presently described species has hitherto failed to make an appearance, so the chance of obtaining a pair *in cop.* and settling their identity or otherwise is extremely remote.

In life an extremely good hymenopterous mimic.

TABANIDÆ.

Tabanus kakhyenensis, sp. nov. (Plate XII.)

♂. *Head*: Eyes bare. Frons about eight times as long as it is wide anteriorly, and rather more than one-third narrower at that point. Frontal callus dark brown, very narrow, not touching the eyes, prolonged upwards linearly for two-thirds the distance to the vertex. In some specimens the callus is hardly wider than its extension. Sub-callus dull, paler yellowish white with median, impressed fine line. Frons and sides of face towards eye margins yellow-grey with black pubescence, which is thicker (the frons therefore appearing darker) on upper half of former. Face beneath antennæ grey-white, with no tinge of yellow, smooth. Jowls with long white hairs. Antennæ; first two joints pale brown with sparce black pubescence and black hairs at upper edge of first and along apical margin of second joint: third joint yellowish to reddish tooth blunt but pronounced, with some black hairs at its tip, the four apical annulations darkened. Palpi grey with white pubescence, closely covered on outer sides with black hairs (which may be thinner basally, the palpi then appearing to have a pale base), not very broad basally, and with apex somewhat pointed. The inner sides appear nearly white by contrast.

Thorax: dorsum black, with golden and black hairs intermingled in approximately equal numbers, giving the whole a dull brown appearance, unstriped. The swelling at each end of the suture with longer, black hairs only. Pleura slate grey with long whitish hairs, of which there are also some above the wing roots and on post-alar calli. Scutellum grey, very shortly pale golden pollinose, with black hairs. The apical margin more violet-grey.

Abdomen brown, with black hairs. The first two segments reddish brown, darkening to very dark brown on the posterior half of the third segment and to almost black on the sixth and seventh. Hind margins of the last five segments broadly but obscurely paler brown (with no shade of red in it). These paler margins not always apparent. On hind margins of second to fourth, sometimes to fifth, segments medianly, small, transversely elongate pale spots with white hairs. In some specimens the whole of the first three segments may be bright yellow brown. Venter similar. The first two to four segments red-brown, remainder blackish. All except apical segments with prominent pale hind margins, not always visible.

Legs black, except basal half of tibiæ, which are obscurely brownish; the junctions of femora and tibiæ always, of tibiæ and metatarsi sometimes, reddish. A fringe of short black hairs on posterior margins of femora.

Wings : Foreborder as far as tip of first vein yellowish, both basal cells slightly infuscated, except for a small elongate streak in upper basal corner of first, and two irregularly elongate streaks one each side of the fourth vein just before its fork in the outer corners of the cells. These streaks are more white than hyaline. Base of anal cell slightly yellow tinged. From tip of first vein a dark, often blackish, band extends to the upper (sometimes to the lower) branch of the fifth vein, bounded concavely exteriorly along the upper branch of the third to the tip of its lower branch, and completely covering the first four posterior cells, and the distal area of the discal cell to a varying extent. The depth of infuscation decreases posteriorly, usually becoming hardly noticeable in the fifth posterior cell. In one specimen the depth of the infuscation is much less, and the edges of the band are diffuse, the whole wing, except the tip, appearing yellowish brown with the bases of the first submarginal and posterior and discal cells clear. There are hyaline streaks in this band in the marginal, first submarginal and all posterior cells, all or any of which may not be apparent. Upper branch of third vein with an appendix, lower branch turned down to meet fourth vein considerably before the margin, thus making the first posterior cell petiolate. In one wing of one specimen the cell is closed only in the margin. Halteres yellow.

Long 13·5 to 18 mm.

Described from three females in good condition from Mohnyin Reserve, Katha, on 15th and 19th May 1919, both the specimens of the later date at light; one female from Pyonchaung, South Toungoo, on 22nd May 1918, and two females from Yanaungmyin, Pyinmana on 3rd and 9th June 1918, all in Upper Burma, and all taken by C. F. C. Beeson, Forest Zoologist. Type from Mohynin, in Forest Zoologist's collection, as are all co-types except one in my own collection.

A male from Pyonchaung, taken at the same time as the female from that place differs considerably from the type female, but is obviously conspecific with one Yanaungmyin female, and so must be the male of this species. The upper and lower eye facets are sharply differentiated, and there are no traces of bands. The thorax shows no differences, but the first three abdominal segments are wholly, and fourth except at the sides, brownish yellow: venter similar. The distinctness and depth of colour of the subapical band of the wing occupies a position intermediate between the very diffuse Yanaungmyin specimen, and the typical specimens from Mohnyin.

This species would, I imagine, be included by Miss Ricardo in her Group V, in her table of Oriental species in *Indian Museum Records*, vol. IV, p. 113,—but it seems most closely allied to *T. nephodes*, Bigot, from the Naga Hills, from

which it differs by the greyish (not red), face and frons, the darker thorax and less distinctly marked abdomen, and the black legs. Miss Ricardo places Bigot's species in her Group VI.

HÆMATOPOTA BEESONI, sp. nov. (Plate XI, figs. 4, 5.)

♀. *Head*: frons yellow-grey with some black hairs below vertex, and some long white hairs between lower outer corners of paired spots and callus. Callus large, shining black, its lower margin evenly curved, its upper produced in the middle somewhat acutely. Paired spots large, barely touching the eyes and callus, unpaired spot small. A large black inter-antennal spot. Upper half of face with a broad black band passing round the antennæ, lower half pale grey with two small black spots in pit-like depressions. Palpi pale yellowish grey, with black hairs on outer sides and at tips, and longer, white, soft hairs basally. Antennæ, first joint yellow with black bristles; second small, cup-shaped, yellow, covered with black bristles; third very dark brown, paler at extreme base, the basal annulation slightly flattened, almost bare, the three apical black and nearly as wide as the tip of the first annulation. The first two joints together are as long as the third.

Thorax dark brown; a median and two subdorsal pale stripes, all stopping just beyond the suture, and, exterior to the latter, post-suturally, a pair of pale stripes which merge into the transversely pale prescutellar area. Shoulders and sides of dorsum pale, the whole with scattered pale silvery-yellow hairs. Pleura pale grey. Scutellum pale basally and darker on apical half.

Abdomen: the first three or four segments reddish-yellow, the apical ones dark brown. There are traces of a narrow median whitish line, only clearly visible on the apical half of the second and on the fourth and fifth segments, with ill-defined small whitish subdorsal spots on the fourth to the sixth segments. Apices of all segments very distinctly whitish. Venter yellowish basally and brown apically.

Legs: fore pair—coxæ grey, femora dark brown with a fringe of black hairs on their inner edges above and below, most noticeable on the apical third below; tibiæ white basally and black on rather more than the apical half, where there are some long black hairs; tarsi black. Middle pair: femora and tibiæ yellowish, the former with some long grey hairs on inner side, the latter with tip broadly brown and a not very well-defined middle brown ring; basal half of metatarsus pale, remainder of tarsus black. Hind pair: femora yellow with fringes of balck hair above and below, strongest below apically; tibiæ yellowish white on basal, black on apical half; metatarsus pale on basal half remainder of tarsus black.

Wings with apical band single, reaching from fore to hind margin, more or less interrupted in second submarginal cell. None of the rosettes very distinct. White apical spots in the first, second, third and fifth posterior cells, interior to which, before the rosettes, is a double row of small spots commencing in the second submarginal and extending to the fifth posterior cell. A zig-zag line, commencing at a Y-shaped fork in upper corner of anal cell, to the axillary region. The ground colour of the wing is much paler basally than apically. Halteres pale yellow with a brown spot on the capitellum.

Long 8 mm.

Described from three females, two in good condition, the third with the antennæ broken, taken by C. F. C. Beeson, Forest Zoologist, after whom I have much pleasure in naming it, at Bondaung, North Toungoo, Burma, the type on 11th May 1918, on the wing, the co-types on 17th May 1918, biting elephants. Type and one co-type in the Forest Zoologist's collection, Dehra Dun, other co-type in my own collection.

This speceis comes in Group III (B) of Miss Ricardo's paper on the Oriental species, but is amply distinct from *atomaria* Wlk. (Borneo) and *unizonata* Ric. (Ceylon Montane Zone) by the black facial stripe of great breadth. The antennæ are very like those of *unizonata*, but that species is larger and has the wing markings much more clear cut.

HÆMATOPOTA DEMELLONIS, sp. nov. (Plate XI, figs. 1, 2, 3.)

♀. *Head*: frons yellow-grey with some pale hairs, the ocular margins white Paired spots large, touching the eyes and frontal callus, white ringed above. Unpaired spot absent, a median white stripe from vertex half-way down the frons. Callus shining black, its upper margin straight except for a small obtuse median projection, the lower margin produced laterally around the antennæ, and the median inter-antennal black spot contiguous. Face ashy-grey, a pair of black spots above contiguous with the callus on a level with the antennæ, and at level of their lowest point a black fleck on each side. Palpi pale yellowish, with a few black hairs on outer side and at tip, and with long white hairs on outer side, especially basally. Antennæ not much longer than the head, the first two joints shining dark brown with some black hairs, the third paler, greatly incrassated on the basal annulation, almost bare except for a few very short black hairs at its upper basal angle. Joints approximately 4 : 1 : 8.

Thorax dark yellowish grey, almost greenish, with a single median and subdorsal pair of stripes, the two latter fading away between suture and scutellum. Lateral margins of dorsum also pale, the general appearance being

that of five pale stripes on a dark ground. Scutellum pale grey with well marked darker triangular admedian spots separated by a median pale linear area. Pleura darker grey.

Abdomen pale grey with well marked admedian dark brown spots forming a pair of stripes, their fore and hind margins on each segment slightly laterally produced, giving the outer margins a 'scalloped' appearance. Seventh segment all dark. The junctions of the segments very narrowly pale yellowish grey. Venter grey with broad median dark stripe, the segmental junctions narrowly white.

Legs: femora dark greyish brown with pale pubescence. Fore tibiæ pale at base and slightly incrassated in apical black half, posterior tibiæ ringed, the hind pair obscurely, the median pale ring being indistinct. Posterior metatarsi with basal half pale. No noteworthy hairs on the legs.

Wings pale grey, the markings not very distinct. Apical band double, the two halves joined on fore and hind margins. The first rosette only well apparent, but the second and third can be made out. Stigma dark brown. Halteres, stem pale and capitellum dark brown.

Long 6·5 mm.

Described from a unique female in perfect condition from Nova Gôa, Portuguese India, taken in September or October 1920, by Major Froilano de Mello, Director of the Bacteriological Institute of that place, after whom I have much pleasure in naming the species.

This species comes in Group V, section B (a), of Miss Ricardo's paper on the Oriental species in *Indian Museum Records*, vol. IV, but is amply distinct from *H. javana* Wd., the only other species to fall into that subsection.

Hæmatopota burmanica, sp. nov. (Plate XI, figs. 6, 7.)

♀. *Head:* frons yellow grey, an indistinct pale line from vertex to unpaired spot, and the ocular margins indefinitely paler. Paired spots hardly touching eyes or callus, unpaired spot small. Callus shining dark brownish black, obtusely produced above medianly, inter-antennal black spot present. Whole of upper half of face with a broad black band (in co-type the upper half of the band is brown, not black, between the eyes and antennæ), lower half of face pale grey with two small black triangular spots. Palpi pale yellowish, with black hairs on outer side and longer pale hairs basally. Antennæ: first and second joints shining yellowish with much black pubescence, third joint dark brownish black, paler at extreme base, which is only very slightly flattened. The first two joints are as long as the third.

Thorax: dorsum dark brown with indistinct pale median and subdorsal stripes, the latter stopping just beyond the suture, and exterior to them a pair of postsutural stripes. Scutellum brown, pleura dark grey.

Abdomen very dark grey, an indistinct pale median stripe and the sides of the segments indefinitely paler. Segmental margins narrowly whitish. Venter dark grey, unmarked.

Legs: fore pair black, coxæ with long pale hairs, and base of tibiæ pale. Mid pair: yellowish, tibiæ ringed, and tip of meta-and last four tarsal joints black; femora with soft pale hairs below and short black hairs at tip making this appear blackened. Hind pair: femora yellowish, darkened at base and tip, tibiæ concolorous, obscurely two ringed, tip of meta-and last four tarsal joints black; femora with a fringe of black hairs, very noticeable apically below, and outer two-thirds of tibiæ black fringed on the hinder edge.

Wings with all the rosettes distinct, the pale markings small. Apical band single, incomplete, stopping in second submarginal cell, there is also a pale spot on hind margin but this is always clearly separated from the band itself. A white ring with, dark centre exterior to the brown stigma. Traces of pale apical markings in first, second, third and fifth posterior cells, and at tip of anal vein in first axillary cell. Two zigzag lines in the axillary region. Halteres pale with brown capitella.

Long 7 to 8 mm.

Described from two females both in good condition, both taken at Bendaung, North Toungoo District, Burma, on 17th May 1918, biting elephants, by C. F. C. Beeson, Forest Zoologist. Type in Forest Zoologist's collection, Dehra Dun; co-type in my own collection.

This species will come in Group VI (F) of Miss Ricardo's paper on the Oriental species. It is very near her *H. hindostani* from the Bababuddin Hills in Mysore, but this species has the legs without noticeable hairs, as have both the other species in this section.

EMPIDÆ.

Tachydromia zeylanica, sp. nov.

♂. *Head* black, frons and occiput covered with shining white pubescence only visible in certain lights. A pair of fairly strong, widely separated vertical bristles, and two pairs of smaller, proclinate, ocellar bristles, the lower the longer, all brown, and an occipital row of bristles, stronger below the upper ones dark, the lower whitish. Antennæ dark brownish, the third, joint nearly three times as long as the first two together, with dark pubescence.

Extreme base of style dark, remainder white, the whole about half as long as the antenna. Proboscis half the height of the head in length, brown, palpi one-third the length of the proboscis, pale yellowish, with a white apical hair nearly twice the length of the palpus.

Thorax dull ferrugineous with minute pale pubescence. Anterior margin of dorsum darkened to blackish, from behind which a broad blackish stripe runs medianly to root of scutellum, towards which it fades into a general darkening behind the level of the wing roots. A chestnut brown subdorsal stripe, hardly reaching the dark anterior area. Pro– and meso-pleuræ ferrugineous, sterno- and hypo-pleuræ darker. From root of front to root of mid coxæ a band of more distinct, white pubescence. Scutellum and metanotum blackish, the posterior margin of the former paler, with an apical pair of bristles. A single, strong, noto-pleural bristle.

Abdomen dull brownish, with traces of ferrugineous laterally, and some sparse pale hairs. A tuft of stiff black hairs ventrally on the apical margin of the last segment. Genitalia swollen, and more blackly shining.

Legs bright yellow. Front coxæ with white pubescence on front side. Front tibiæ and tarsi dark brown, tips of hind tarsi black. The whole with short golden pubescence. Mid femora greatly incrassated.

Wings pale greyish, veins brownish, third and fourth not converging apically. Halteres yellow.

Long 2 mm.

Described from two males in good condition, taken on a hedge in evening at Emelina Estate, Maskeliya District, Ceylon (4,200 ft.), on 12th May 1919. Type and co-type in my own collection.

This species is most nearly related to *T. nepalensis* Brun. but is distinguished from that species by the thoracic pattern and the non-narrowed tip of the first posterior cell. It is the first species of the genus to be described from India south of the Himalaya.

REVISED KEY TO THE INDIAN SPECIES OF ELAPHROPEZA, Macquart.

1. Thorax shining black .. .. 2.
   Thorax brownish yellow .. .. 3.
2. Basal half of abdomen reddish yellow, apical half black .. *basalis*, Bezzi.
   Abdomen wholly black .. .. *bicoloripes*, Brun.
3. Abdomen unicolorous, or base pale and apex darker .. 4.
   Abdomen with apex and base pale, middle area, black .. 9.
4. Occiput blackish .. .. 5.
   Occiput yellowish .. .. 8.
5. Tips of fore tibiæ all fore tarsi and last joint of posterior tarsi black. Wings smoky .. .. *fulvithorax*, Wulp
   Legs practically unicolorous. Wings clear .. .. 6.

6.	Style thickly pubescent (bottle-brush-like)	*plumicornis*, sp. nov.
	Style normally microscopically pubescent	7.
7.	Thorax with supra-alar and two pleural black spots ..	*notatithorax*, sp. nov.
	Thorax uniformly ferrugineous yellow	*abdominenotata*, sp. nov.
8.	Third antennal joint black	*ferruginea*, Brun.
	Third antennal joint yellow	*distincta*, sp. nov.
9.	Occiput yellow	*nigropunctata*, sp. nov.
	Occiput black	10.
10.	Tips of tibiæ and tarsi brownish	*metatarsata*, Bezzi.
	Legs wholly yellow	*variegata*, Brun.

ELAPHROPEZA PLUMICORNIS, sp. nov. (Plate XIV, fig. 9.)

♂. *Head*: frons and occiput blackish grey. Ocellar bristles long, cruciate, verticals inwardly directed, occipital row fairly strong, all pale. Antenna, first two joints brownish, third, except extreme base, blackish. Style thickly pubescent and nearly twice the length of the antenna, quite unlike those in the other described species, in which it is only microscopically pubescent, in accordance with the generic character. Proboscis and palpi ferrugineous.

Thorax bright reddish ferrugineous, with short pale hairs, unmarked, save for an indefinite arcuate black line in the position which the transverse suture would occupy, if present. Scutellum concolorous, metanotum darker reddish-brown.

Abdomen dark reddish brown with pale pubescence, venter more yellowish.

Legs yellow to tips of tarsi, the outer half of the hind femora slightly darker. Hind tibiæ with a distinct hood-like process on inner side over the metatarsal articulation.

Wings yellowish, the costa strongly ciliate as far as the tip of the first vein, the second vein ending slightly beyond half way between the tips of first and third veins. Anterior cross-vein and fourth vein very weak until the latter is the length of the posterior cross-vein past its junction therewith. Halteres all yellow.

Long 2 mm.

Described from a unique male, in good condition, taken on a hedge at Suduganga, Matale District, Ceylon, on 18th January 1920. Type in my own collection.

Easily distinguished by the 'bottle-brush' plumosity of the style. A female *E. fulvithorax* (v. d. W.) was taken during the same month in the same place, but this species (of which I also possess the male) is amply distinct by the much darker wings, the darkened front tarsi and the bristles on the posterior side of the hind tibiæ, which are apparently absent in my species.

ELAPHROPEZA NOTATITHORAX, sp. nov. (Plate XIV, fig. 10.)

♂. *Head*: frons and occiput very dark brown. A pair of proclinate ocellar bristles, on a level with and exterior to which is an erect bristle on each side. Verticals somewhat forward-directed, occipital bristles very short. Antennæ, basal joints yellow, third blackish, the style twice as long as the antenna. Proboscis and palpi very short, brownish yellow.

Thorax reddish ferrugineous yellow, paler pubescent. A black spot dorsally above and in front of wing roots on each side, and similar ones over roots of mid and hind coxæ. A general darkening on metapleura. Scutellum concolorous, a narrow black basal area. Metanotum blackish, sometimes paler brownish in middle underneath the scutellum.

Abdomen with basal segments yellowish, apical dull blackish, the whole with short stiff dark hairs. Genitalia small (contracted), yellowish.

Legs uniformly yellow. Tip of hind tibia with a pair of strong black curved spines on anterior margin, on posterior margin a sort of flap, outlined in brown, closely appressed to shaft of tibia over the metatarsal articulation.

Wings hyaline greyish, veins yellow. Anterior cross-vein and fourth vein weak from base to about the length of the posterior cross-vein beyond its junction with the latter. Ciliation of the costa strong as far as tip of first vein or a little further. The second vein ends exactly midway between first and third. Halteres, stem yellow, capitellum blackish.

Long 1·5 mm.

Described from two males in good condition, taken on a window at Suduganga, Matale District, Ceylon (1,386 ft.), on 29th May 1919, and 12th September 1920. Type and co-type in my own collection.

ELAPHROPEZA ABDOMINENOTATA, sp. nov.

♀. *Head*: occiput and vertex black, the latter with greyish shimmer; face more greyish. Occiput somewhat swollen. Vertical and ocellar bristles procumbent. Antennæ, first joint pale yellowish, second and third dark brown, the former with apical setæ, the latter pubescent. Style one and a half times as long as antenna, moderately pubescent. Proboscis half height of head, brownish yellow, palpi white, with some apical hairs, incumbent on proboscis, and half its length.

Thorax shining ferrugineous, unmarked, dorsum very slightly darker in shade. Pleura, scutellum and metanotum concolorous, except for a small black area on metapleuron between base of halteres and side of metanotum.

Abdomen first three segments pale dirty whitish yellow, a pale greyish brown spot at extreme edge of dorsal margin on second and third. Remainder

of dorsum brownish, with short pale pubescence. Venter uniformly pale dirty whitish yellow.

Legs yellow, anterior tibiæ and tarsi and hind tarsi slightly darkened, also junctions of posterior femora and tibiæ. Fore coxæ with two basal bristles on front margin, mid femora with a preapical bristle and the underside with short spiny bristles, mid tarsi with strong, short, black spines and an apical tooth. Hind femora on upper side basally with three strong bristles, otherwise only with soft hairs above and below : tibiæ with two strong bristles equidistant from one another and each end of the joint.

Wings hyaline, costal cilia rather long and widely spaced as far as end of first vein, beyond which they are shorter and more closely set. Second vein ending at one-quarter to one-third of distance between first and third. Halteres pale yellowish

Long 1·25 mm.

Described from a unique female in good condition, taken on window, Suduganga, Matele, Ceylon, on 23rd August 1921. Type in my own collection.

Elaphropeza distincta, sp. nov.

♀ . *Head* yellow, frons narrow but distinct. Ocellar triangle with two pairs of bristles, one erect, one porrect. Verticals two pairs, the inner small, converging, the outer long, nearly parallel. Proboscis short, yellow ; palpi whitish with subapical black bristle, not as long as proboscis. Antennæ wholly yellow, the third joint short, not much more than twice the length of the second. Style yellow with the usual microscopic pubescence.

Thorax and scutellum uniformly yellow, the latter with a pair of strong parallel apical bristles. Metanotum dark with middle area ferrugineous.

Abdomen yellow, the apical half of dorsum with brown patches, the tip upturned, anal lamellæ yellow, small.

Legs uniformly pale yellow.

Wings clear, the tip of second vein nearer that of first than of third. Halteres yellow.

Long 1·5 mm.

Described from a unique female in good condition, taken on window, Suduganga, Matale, Ceylon, on 12th September 1921. In my own collection.

Elaphropeza nigropunctata, sp. nov.

♂ . *Head* yellow, the very narrow frons more brown. Ocellar bristles strong, proclinate, verticals strong, widely separated, erect. Between the ocellar triangle and the vertex are two pairs of small proclinate bristles. Occipital

row situated well behind eyes, fairly strong, ending in a strong genal bristle. All bristles yellowish. Antennæ, the two basal joints yellow, the third dark blackish brown, with extreme base more yellowish. Proboscis and palpi yellowish.

Thorax bright ferrugineous yellow, unmarked dorsally, but with a large black spot on hypopleura. Scutellum and metanotum concolorous, the former with a large black spot occupying all but its lateral margins, the median area of the latter broadly brownish-black.

Abdomen with segments 1 to 3 and 5 and 6 whitish yellow, the fourth segment nearly as long as the first three together, black with pale hairs. Genitalia dark brown above, ventrally yellow.

Legs yellow, front tibiæ and tarsi, mid tarsi, processes at tips of hind tibiæ, and last four tarsal joints, very slightly browner. Hind femora with about seven strong yellow bristles basally above, and about four short black spines on underside subapically. Hind tibiæ with two strong bristles towards middle of posterior margin, and their apex produced behind the articulation of the metatarsus on inner side into a short blunt process. Hind metatarsus somewhat incrassate, with two longish bristles on inner side before the middle.

Wings faintly tinged yellowish, the costa strongly bristled as far as the end of the first vein, whence their length decreases to normal ciliation a little way beyond the tip of the second vein, which is situated at one-third the distance between the tips of first and third veins. Halteres yellow, capitellum elongate.

Long 2·5 mm.

Described from a unique male in good condition, taken on the wing round flowers at Maskeliya (*circa* 4,000 ft.), on 23rd February 1919 (G. D. Austin). Type in my own collection.

PHORIDÆ

Aphiochæta flavifacioides, sp. nov.

♀. *Head*: frons yellow, grey dusted, with scattered short black hairs, face antennæ and palpi all bright yellow. Ocellar tubercle distinct, black, the two upper ocelli dividing the vertex into three approximately equal lengths. Frontal groove weak but distinct. All bristles black. Verticals two, situated midway between edge of eye and upper ocellus on each side, strong, divergent: upper frontals four, in a straight line, lower frontals in two pairs, the bristles of each side approximated to one another and to eye margins, the inner pair slightly lower, inclined inwards towards one another, very little above the

level of the upper proclinate pair, which are much larger than, and very slightly exterior to, the very small lower pair. Arista dark brown, minutely plumose.

Thorax bright yellow with black pubescence, stronger and thicker towards the sides and hind margin of the dorsum, leaving a broad median stripe which appears a brighter yellow viewed from behind; some indefinite infuscation, medianly before root of scutellum which is slightly darker yellow, bare. Pleura very pale whitish yellow, bare. All bristles black, a humeral, three notopleural close together, an anterior supra-alar,—(these four in a straight line gradually ascending posteriorly)—two posterior supra-alar, the anterior very small and in a line with outer edge of base of scutellum, the posterior very strong, on hind corner of dorsum; a prescutellar dorso-central pair and a subapical scutellar pair, these last two pairs somewhat erect. Metanotum black, with some brownish tinge towards hind margin.

Abdomen: dorsum and sides very dark brownish black, second and third segments broadly dull brown basally, venter as far as sixth segment bright yellow: seventh and eighth segments small, all black, except extreme dorsal base of former, brownish, and hind margin, pale greyish, dorsally and laterally. Ovipositor small, yellow, hairy.

Legs pale yellowish white, hind femora black at tips and hind tarsi slightly darkened. Mid tibia with a single long spur, hind tibia with two spurs, of which one is half the length of the mid spur, the other very small.

Wings clear, veins yellow. Auxiliary well distinct, downcurved into first at half the length of the latter, third ending at middle of wing, the fork wide, first discal evenly curved, second and third bisinuate, the former strongly, fourth straighter, all reaching the margin. Costa with a very strong basal bristle, then about six very small ones, and about seventeen rather widely spaced bristles of considerable length. Halteres yellowish.

Long 1·25 mm.

Described from a unique female in good condition at time of description, now headless, taken at Cherrapunji, Khasia Hills, on 18th October 1920. In my own collection.

Separates at couplet K K of Brunetti's table of Oriental species on the yellow venter.

PHORHYNCHUS CINCTIVENTRIS, sp. nov. (Plate XIII, figs. 3, 6, 7.)

♀. *Head*: vertex, frons and face at sides shining black, centre of face, and some mottling on lowest quarter of frons, orange. A vertical row of four bristles in a straight line, two, admedian, below lower ocellus, two, exteriorly

at centre of frons, four in a curved row, its convexity downwards, at two-thirds length of frons, and a median pair, their bases closely approximate, just above epistomal margin, from which there runs an impressed line between these bristles on lowest quarter of frons. An occipital row of bristles and a very strong genal pair, the shorter anteriorly, the longer posteriorly directed. All bristles black, the frontal all reclinate. Eyes minutely pale pubescent. Antennæ, palpi and proboscis orange. Antennæ with third joint very large, hiding the others, pyriform, acuminate, slightly infuscated at tip. Arista long, bare, of two joints, the first minute, basally brownish, remainder black. Palpi with two strong bristles at tip, lower edge with two strong bristles towards tip and a basal row of quite small bristles. Proboscis as in generic diagnosis, slightly darkened towards tip above.

Thorax with dorsal margin very square-cut. Dorsum black, postalar calli yellowish, with closely set black setæ. Pro-, lower half of mesopleuron, and pteropleuron, black, upper half of mesopleuron grey pruinose. Sternopleuron yellow, hypo-and meta-pleuron yellow with white pruinosity, the front margin of former with a large spot of black contiguous with the same colour on pteropleuron. Anterior spiracle prominent, pale. Two propleural bristles, a humeral, a notopleural, two supra-alar and one post-alar and a prescutellar row of six, all strong and black. Scutellum black, bare, with four strong black marginal bristles, the outer pair situated midway between base and inner pair. Metanotum dull black.

Abdomen: basal segment dull yellowish, hind margin with a whitish band, narrowed at centre of dorsum. Second to fourth segments black, fifth yellow, sixth black with extreme hind margin yellowish, seventh and eighth seemingly forming part of the ovipositor, the former with hinder margin very narrowly pale, and each with a lateral bristle. Ovipositor cylindrical, acuminate, slightly chitinized, pale yellowish white, with two long bristles on dorsal margins towards the base, and an apical ring of long hairs, the whole organ covered with small bristles.

Legs: front pair throughout yellowish white. Posterior coxæ yellow—(the hind coxæ are partially concealed by the very incrassate hind femora)—mid femora and tibiæ pale yellowish, tarsi darker, really owing to more closely set setulæ. Hind femora with rather more than basal half yellow, outer half and extreme upper edge, which is shortly pectinate, throughout black. Hind tibiæ yellow, but appear black with extreme base only yellow owing to the very closely set setulæ; hind tarsi yellowish. Anterior coxæ bristly at apices, front tibiæ with a single bristle on anterior edge towards the middle, posterior tibiæ with a similar bristle and three apical spurs. All

tarsal joints with apical bristles, and front metatarsus and posterior first two tarsal joints with a longitudinal row of small bristles in addition. The whole of the legs, except coxæ, minutely black setulose.

Wings yellowish-grey, the apex very slightly infuscated. Venation as in *P. ater*, but the third and fourth discal veins are hardly bisinuate. Halteres pale yellow.

Long 5·5 mm.

Described from a unique female, in good condition, taken flying round a bush in the Royal Botanic Gardens, Peradeniya, Ceylon, on 23rd May, 1920.

Type in my own collection.

This peculiar genus seems to be confined to Ceylon.

TRYPETIDÆ.

Mellesis polistiformis, sp. nov. (Plate XV, fig. 9.)

♂. *Head* dull brownish yellow, frons exceeding in width one-third of head, paler yellow, vertex brownish with short while pile, ocellar triangle black. Below triangle, to middle of frons, runs an indefinite, very slightly darker bar, caused by there being a pair of admedian patches of almost imperceptible pale pile with a few very short white hairs. At middle of frons a transverse, irregular brown spot near eye margin on each side, prolonged inwardly as a narrow streak, but not meeting in the middle. Junction of face and frons at level of antennal roots with an elongate brown spot between eye margins and suture. Frontal lunule darkened. Face distinctly convex, almost yellow, knobbed immaculate, except for a brown transverse stripe along epistomal margin, the ends of which are upturned to meet antennal grooves. A brown spot at lower corner of eye at junction of parafacialia and genæ. Facial suture with a row of short pale hairs. Bristles golden brownish : verticals two, ocellar wanting, upper orbitals wanting, lower orbitals two pairs, the upper reclinate, at level of and exterior to mid frontal spots, lower proclinate, inwardly directed, in line with highest point of lunule, both pairs small. Lower middle area of frons with some scattered short brown hairs. Genal bristle strong, occipital row short, of a few bristles only. Antennæ dark yellow, arista black with yellow base. Palpi yellow, with a few pale hairs, proboscis brown.

Thorax reddish yellow, with short golden pubescence on dorsum and whitish hairs on pleura. Transverse suture broadly interrupted towards the middle, its anterior side with a pale yellow stripe crossing posterior half of mesopleuron and ending as a yellow spot on upper edge of sternopleuron.

Hypopleural spot, large, pale yellow, single, above it an indefinite dark spot each side of the brown metanotum. Scutellum pale yellow, very narrow. Chætotaxy greatly reduced,—only posterior notopleural, two post-alar and two scutellar bristles, all brownish yellow.

Abdomen strongly pedunculate, with apical segments clavate, reddish brown with thick covering of golden hairs. First segment with its bilobed base and its apex paler yellowish, second with median paler stripe on posterior half and paler hind margin, third darker medianly, and with a fan of strong yellow bristles laterally, fourth and fifth with anterior margins blackened. Sides and venter unmarked, save for a paler yellow area laterally on second segment. None of the abdominal markings well defined, the colours shading into each other. Genitalia small, dark brown, retracted.

Legs brownish yellow, bases of posterior femora and tibiæ and all tarsi paler, whitish yellow. Fore femora with three long strong black spines below mid tibiæ with a single strong black apical spur.

Wings yellow, fore margin above fourth vein intensely so, axillary region clear. A subapical triangular black spot, based on costa between tips of second and third veins, with apex in middle of first posterior cell midway between the tips of the cross veins. Second section of fourth vein straight, second basal cell about four times as long as wide, first basal cell ciliate above second. Anterior cross-vein in line with tip of first vein, beyond middle of discal cell. Anal cell with its apex enormously drawn out, its tip hardly more distant from the margin than is the lower end of the posterior cross-vein. No supernumerary wing lobe. Halteres pale yellow.

Long 9·5 mm.

Described from a unique male in good condition taken at Sukna, 500 ft. (base of Eastern Himalayas), (H. A. Inglis) on 4th December 1920. In my own collection.

Bezzi's original definition of *Mellesis* (*Bull. Ent. Res.* VII. 114) would exclude this species on account of the spined fore femora, but in his more recent key to all the genera of the *Dacinæ* (*Phil. Jo. Sci.* XV. 415), he admits species with spinose femora to the genus. In favour of this species being correctly located here are the interrupted transverse suture, straight fourth vein and absence of acrostichals; against it is the convex face, as in *Monacrostichus*, Bezzi. However it has more affinities with *Mellesis* than with the latter genus, though in some respects it forms an annectant link between them. In Bezzi's table of Indian species of *Mellesis* it separates on the spined femora refusing to fall into either portion of couplet 1 (4), possessing as it does characters contrary to either line of the couplet.

Enderlein (*Zool. Jarhb. Jena, Abt. Syst. Zool.* XLIII. 336-360; 1920) has recently described *Polistomimetes minax,* gen. et sp. nov., from Sikhim, the descriptions of which I have been unable to consult. Until the 'Higher Command' of Zoology makes a definite pronouncement in regard to the acceptance or otherwise of post-war German work I feel justified in describing without reference to it.

STAURELLA LUTEIFASCIATA, sp. nov. (Plate XIV, fig. 2.)

♀. *Head*: vertex yellow, frons concolorous, its middle below slightly brownish, with a black, diamond-shaped patch, its upper angle truncate across a line just touching the lower edges of the posterior ocelli, between which the black area is slightly produced upwards, its lateral angles at the upper fronto-orbitals, and produced above them obliquely to eye margins as brownish ill-defined streaks, its lower angle just above the level of the middle pair of lower orbitals. Face concolorous, strongly concave, epistome prominent. Genæ concolorous, also lowerf hal of occiput, the upper half of which is black, save for a vertical lunulate yellow area continuous with the vertex and extending somewhat below the postverticals. Antennæ with first two joints yellowish, the third with extreme base concolorous, the remainder orange, three times as long as the second joint, with tip acuminate. First joint apically setose, second with the whole of the upper surface bristly. Arista brown, basal joint more orange, very short plumose. Palpi yellow with four or five strong bristles. Ocellar bristles absent, verticals strong, inner pair parallel, outer divergent, postverticals parallel. Orbitals 1 : 3, the upper erect, the lower porrect and inwardly directed. The uppermost lower orbital is on a level with, but external to, the upper orbital. The distance from the uppermost to the middle lower orbital is twice that from middle to lowest. Occipital row weak. Genal strong. All black. Eyes in life purple, with green bands in the form of a Maltese cross.

Thorax chestnut brown. Dorsum flattened, with fine black hairs. A median pale yellow stripe, narrower anteriorly, from suture to apex of scutellum, evenly broadened, so that on the scutellum, which is concolorous with the thorax, it occupies the middle third. A black admedian stripe starting from a black patch above the scapular bristle, interrupted over the posterior half of the presutural area, and again broadened out from dorso-central bristle to posterior margin, not continued on to scutellum. From just within the upper posterior supra-alar to level with the dorso-central a short, subdorsal brown stripe. Pleura chestnut brown, the dorso-pleural suture with a yellowish-white stripe from humerous to wing root, anteriorly broadened to cover all the former, and slightly so towards the latter. Metanotum dark castaneous with

median black stripe. Bristles black; humeral 1, noto-pleural 2, presutural wanting, dorso-central present, supra-alar 3, mesopleural 2, pteropleural strong, sternopleural strong. Scutellum with two basal and two apical bristles, all strong and parallel. Its upper surface is flattened like the thoracic dorsum.

Abdomen castaneous brown, the sides of the dorsal surface of the first three segments black, the base of the fourth slightly more broadly, and the whole of the fifth except a median bar and the extreme hind margin, also blackish, but the markings on the two latter segments only visible when light falls on them from the side. Venter paler brown, a median black stripe broadly on first two segments and the hind margin of the fifth darkened. Ovipositor as long as and concolorous with abdomen, circular in section, as broad as last segment basally, apically acuminate, with a black band all round the tip.

Legs uniformly yellowish. The bristles of the fore femora strong above, fewer and weaker below.

Wings: stigma brownish yellow. From just beyond tip of first vein a marginal dark border, much broader apically, shortly but definitely interrupted at tip of third vein, extends to middle of second posterior cell. Over posterior cross-vein and last segment of fifth vein a dark stripe, broadened around upper end of cross-vein and on wing margin. A very faint infuscation, rounded over lower end of anterior cross-vein. Anal cell slightly shorter than second basal, anterior cross-vein at more than half the length of the discal cell. Base of third vein with about five bristles. Halteres yellow.

Long, with ovipositor, 6 mm.

Described from a unique female, in perfect condition, taken on window, Suduganga, Matale, Ceylon, at dusk on 17th August 1921. In my own collection.

This species fully accords with the generic diagnosis, save for the acuminate tips of the antennæ, agreeing with *S. nigripeda* in the position of the anterior cross-vein.

Staurella zeylanica, White.

In my description of this species I was in error in stating that the third vein possesses only two basal bristles. This is so as regards the lower surface, but the upper surface has the vein bristly to beyond the anterior cross-vein.

This would make the species run out at *Ptilona* in Bezzi's key, but it is excluded from Wulp's genus by the presence of the dorso-central and the number of orbital bristles. The head, too, is slightly wider than high. As it agrees with *Staurella* in thoracic chætotaxy I leave it therein, in spite of the bristles of third vein being at variance with Bezzi's definition of his genus.

RIOXA PUNCTATIPLEURA, sp. nov. .(Plate XIII, fig. 4.)

♂ ♀. *Head* yellow, a median brown facial spot above epistomal margin. Antennæ and palpi concolorous, proboscis brown. Verticals two, postverticals parallel or slightly diverging, orbitals 2 : 1, but there may be adventitious smaller bristles above and below the lower. The upper superior orbital much shorter than the lower. Ocellar absent. All yellow. Occipital row of thin, pointed, yellow bristles.

Thorax yellow, with pale pubescence except over black areas. A presutural sub-dorsal ovate black spot, a post-sutural dorso-central black bar, interior to which with its tip in line with the tip of the bar is an elongate black spot, which may be fused with the bar, thus making its anterior end spatulate. Before root of scutellum the end of the bar is in-curved, and between the two ends on each side there is sometimes a median brown spot. Sometimes the two in-curved ends and the median spot fuse to form a complete cross-bar. when the post-sutural thoracic markings all unite into a U-shaped mark. Pleura yellow, a large black spot on anterior margin of mesopleuron, another occupying most of central area of sternopleuron, another the lower half of pteropleuron, and another on the hypopleuron. Mesopleural bristle single, pteropleural strong. Scutellum pale yellowish, six bristled, the middle pair weaker and the apical pair crossed. All thoracic bristles yellow. Metanotum with sides and centre pale, and sub-dorsal broad dark brown bars.

Abdomen yellow with pale pubescence. Third, fourth and fifth segments with basal black bands more or less interrupted at the middle of the dorsum the band on second segment often weak or absent. Ovipositor brown with yellow apex, about as long as last two segments.

Legs all yellow.

Wings with three oblique yellowish grey bands, the first from tip of the subcostal vein slightly zigzag over tip of second basal and anal cells, fading in axillary region ; the second starting broadly on the costa before the tip of the second vein, and running obliquely over anterior cross-vein into discal cell ; the third starting on the costa about half way between tips of second and third veins above, and from tip of fourth vein below, running over posterior cross-vein and fading away in third posterior cell. Subcostal cell and extreme base of wing yellowish. Veins yellow, the second through the middle band, the fourth beyond posterior cross-vein, the latter, and the basal cross-vein, black. First vein bristly to tip, third vein to midway between anterior cross-vein and tip.

Long 5·5 mm.

Described from 2 males and 3 female paratypes, none of them in good enough condition to be regarded as the ultimate type, taken in Colombo in July, November and December 1914. In Colombo Museum and my own collections.

This species does not belong to *Rioxa, sens. strict;* but that genus is now, as regards the Oriental forms, merely an assemblage of species awaiting the specialist for proper dismemberment.

In the generic definition Bezzi (*Mem. Ind. Mus.* III. 111), states that the cephalic bristles should be black, but proceeds to add to the genus the *stellata* group, in which some of the frontal bristles are yellow. Edwards adds to the genus *flavicans*, exhibiting a totally different wing pattern, but his description is insufficient, as it is silent on the subject of bristle coloration (*Jo. F. M. S. Mus.* VIII. 50). The presently described species also has the wing pattern different from the species included by Bezzi, and further is at variance with generic characters in the single mesopleural and strong pteropleural bristles, and the shortened anal cell. The all yellow head bristles are quite exceptional. Against its belonging, however, to Bezzi's second section of the family, which divides on this character, are the spiny third vein, pectinate arista, six-bristled scutellum, and a wing pattern which is equally at variance with *Tephrella* and *Tephrostola*, the only two possible genera which could receive it.

The publication of new species in all families, as they come to hand, which is the purpose of the present series of papers, is only justified from the systematic point of view in that it calls attention to the many aberrant forms which the Indian Fauna produces, and provides Specialists with material on which to build up a sufficient knowledge for proper generic conception in their particular groups. Unless a new species is so totally at variance with all known genera that it utterly fails to fall into one of them in its widest sense, the erection of new genera in such papers is, to my mind, quite unjustified and a hindrance to the specialist, hence I leave the present species in *Rioxa*, contenting myself, as I have done in other instances, with pointing out its discrepancies from the generic definition.

Tephritis tribulicola, sp. nov.

♂♀. *Head* yellow, frons wider than one-third of head, slightly narrowed below, varying from pale lemon to dark orange yellow, usually darker in ♀, with a darker luniform mark, convexity upmost, across its middle, from centre of which projects a short line towards the ocellar triangle, and occasionally towards the antennæ also,—this mark often not being apparent in the darker specimens. Ocellar triangle darkened. Face pale, in some specimens almost

white. Antennæ yellow, the basal joints paler, with black bristles, the third joint bare, one and a half times as long as the second, rounded apically, with bare arista, which has the rather enlarged first joint orange, the second black. Bristles: verticals strong, the inner pair parallel, the outer divergent, brown; postverticals parallel, very pale yellow, not much longer than the adjacent bristles of the concolorous occipital row; fronto-orbitals 2 : 3, the upper brown, the lower black,—(the type ♂ has an adventitious fourth lower bristle on one side between the upper and lower sets); ocellars strong, black; genal strong, brown. Parafrontalia with short white hairs, only visible from above; lateral epistomal margins with black, and genæ with white hairs. Palpi and proboscis yellow, the former with short black apical bristles.

Tephritis tribulicola.

a, Larva in hibernating condition, natural size and magnified (×6½).
b, Fly, natural size and magnified (×6½).

Thorax: dorsum yellow, the whole of the disc with an oblong black patch, leaving only all the margins yellow, the black colour extended forward on the mid-line to the neck as a black stripe, and incised at the suture, and, triangularly, on hind margin between the prescutellars, which stand on its hinder edge. These markings are only clearly visible in rubbed specimens, in fresh ones the dorsum is too thickly covered with very pale rather broad hairs, and in life appears olive green. Four small black spots at the insertions of the dorso-centrals and prescutellars. Pleura from pale to dark yellow, sterno- and hypo-pleura with large black spots covering most of their lower halves, that on the former with a patch of pale hairs. Scutellum equilateral triangular yellow, darkened basally. Metanotum with a transverse yellow area immediately below the scutellum, the remainder black, with a linear black stripe running from below across hinder edge of metapleura, in front of root of halteres and posterior stigmata, to upper margin of hypopleura. Chætotaxy complete,

two mesopleural; ptero- and sterno- pleurals strong, black, other bristles brown. Scutellum four-bristles, the apicals parallel and as strong as the subapicals, all brown.

Abdomen: dull yellow, with whitish bristles, appearing olive green in life. In the male the basal margins, dorsally of the second to fourth segments is very indefinitely darkened, the fifth has basally two admedian and on each side a marginal black spot, well distinct. Lateral margins of third to fifth segments strongly bristly. In the female the bases of all the segments are often blackened, but in unstained specimens the fifth and sixth (sometimes also the fourth), show a pair of basal admedian black spots, of which those on the sixth may be confluent. Fifth segment with lateral, sixth with lateral and dorsal hind margins with strong bristles. Male genitalia yellow, the type (taken *in cop.*), has a coiled concolorous tubular process, as long, if unrolled, as the whole abdomen, which is of an increased diameter apically, otherwise normal, small. Female ovipositor as long as the preceding four segments, brown, with black pubescence and tip, strongly flattened dorso-ventrally.

Legs: uniformly pale yellow.

Wings: hyaline, lightly brownish infuscated as follows:—stigma (outer edge of which is often considerably darker); very indefinitely over upper outer angle of second basal cell; over anterior cross-vein, at tip of second vein; and with apex more definitely blackened. In addition there is a brownish band commencing on costa midway between tips of first and second veins, interrupted in first posterior cell, and continuing along posterior cross-vein. Anterior cross-vein not much beyond middle of discal cell, and only very slightly distad of tip of first vein. The cross-veins not parallel, the posterior sloping slightly inwards posteriorly. Anal cell with acuminate point, as long as second basal. Third vein with two small bristles at its origin. Halteres pale yellow.

Long, without ovipositor, 6 mm. Ovipositor 2 mm.

Described from four males and six females mostly in good condition, taken on thistle at Shillong between 25th September 1920, and 7th October 1920, and at Mawphlang on 10th October 1920, by the Imperial Entomologist and myself. Type male and allo-type female taken *in cop.* on the same plant, 7th October 1920. Type and other specimens in my own collection. A considerable number, taken on the same plant at Shillong in previous years, in the Pusa collection seen by me. Except for the non-parallelism of the cross-veins this species agrees well with the genus *Tephritis* Latr., the much reduced wing pattern, however, is very different to its Indian congeners, and is more like *Zonosema* Loew,—but it cannot be allocated to that genus on account of the pale occipital bristles, the costal spine, and the double mesopleural

bristle. In Bezzi's key to the Indian species of *Tephritis* this species runs to couplet 5 and separates from *zonogastra* Bezzi on the very different wing pattern.

In life the species resembles a greenish *Chætodacus*.

TRYPANEA PENTADACTYLA, sp. nov. (Plate XV, fig. 10.)

♂. *Head*: pale yellow, frons white-dusted, occiput with a black V-mark from vertex to neck. Antennæ, proboscis and palpi yellow, the first with the third joint short, acumitate with black, bare arista of which the extreme base is yellow. Orbitals 1 : 3, the uppermost of the lower range further from eye margins and distinctly darker.

Thorax: dorsum, scutellum and metanotum pale slate grey, the two former with whitish bristles. Pleura greyish, with yellow pollen. Chætotaxy complete, scutellum with two bristles.

Abdomen: grey, with yellowish pollen and whitish bristles. Genitalia small, brown.

Legs all yellow.

Wings: costal bristle very strong. A dark bar from tip of auxiliary vein to middle of first posterior cell, leaving the extreme tip of first vein and first half of costal edge of marginal cell clear. Outer two-thirds of sub-marginal cell are darkened except for a clear dot above the anterior cross-vein and two spots on the costal margin, between which the infuscation is much darker. A circular clear spot on the anterior side of fourth vein, between the cross veins, with a smaller, dark spot in the general infuscation above it, just below the third vein. Obliquely below the tip of the second vein the dark bar splits into five rays, which run to the tips of the third, fourth and fifth veins and between the two latter, two others, equidistantly, to hind margin in second posterior cell. Upper outer corner of discal cell infuscated, an abbreviated ray running from the tip of the anterior cross-vein nearly across the cell. Costa yellow except through the dark areas, with which it is concolorous. Sixth vein stopping short well before margin. Halteres yellow.

Long 4 mm.

Described from a unique male in fair condition, taken at Banhar, North Bihar on 13th March 1921. (*H. A. Inglis*). Type in my own collection.

The much greater amount of infuscation between the tip of the auxiliary and the anterior cross veins, and the upward directed apical ray to tip of the third vein, amply distinguish this species from its two Indian congeners which have the frontal bristles arranged 1 : 3.

DIOPSIDÆ.

Teleopsis bipunctipennis, sp. nov. (Plate XIII, fig. 1.)

♂♀. *Head*: width across tips of eye stalks 2½ times that of thorax in male, twice that of thorax in female. Frons black, ocelli golden, on a somewhat elevated triangle. A subtriangular reddish spot below and exterior to ocellar triangle, eye stalks and occiput reddish, a triangular black area based on eyes extends along eye stalks above until it fuses with the black vertical area, which extends backwards, broadly, to neck, which is reddish. Frons with short black hairs and a long bristle above at inner corner of eye, and divided from face by a black ridge, more distinct in male. Face reddish, with pale silvery pubescence and hairs. Epistome distinct, mouth parts hidden, except yellowish labellæ, which are strongly ridged. Antennæ reddish, second joint with apical margin dark with short black bristles, outer margin of third below the black, bare, arista with pale yellowish pubescence.

Thorax: shining black, with sparse long soft erect hairs. Humeri and pleuræ with pale pubescence. A notopleural bristle, no longer than the dorsal hairs, and a long, strong, supra-alar. Metapleural spine short. Scutellum concolorous, with short black hairs and an apical pair of long, brownish-black spines, each of which bears at its tip a long black bristle, twice as long as the spine itself.

Abdomen: black, shining, the terminal segments in both sexes down-curved and somewhat swollen. Lateral margin with a fringe of short, soft, black hairs. Male genitalia concealed, in female a pair of small yellow lamellæ visible. The membrane between the segments, when exposed as by the down-curving of the apical ones, pale brownish.

Legs: coxæ yellow, fore pair with shining white pubescence on basal half exteriorly. Fore femora reddish-yellow, incrassate, with a row of short black teeth and some longer hairs below, darkened apically, with shimmering white pubescence sparsely distributed over posterior side, and concentrated in a patch at inner edge of apical infuscation on anterior side. The pubescence only visible when viewed with tip of femora towards observer. Posterior femora yellow, with apical third black. Fore tibiæ black, except for the extreme base, yellow, Mid tibiæ basally yellowish, darkening to dark brown on apical two-thirds, hind tibiæ with basal half yellowish, darkening to dark brown on apical half. Tarsi yellowish, except fore metatarsi, which are brown exteriorly, the inner sides thickly furnished with bright golden pile.

Wings: extending beyond the tip of abdomen, infuscated, with sub-apical clear patches in sub-marginal and second posterior cells, the latter immediately

beyond the posterior cross-vein. The infuscation fades to almost clear in the costal and axillary cells. Halteres yellow.

Long: 5 to 6·5 mm. the female distinctly the larger.

Described from five males and seven females, all in good condition, and all taken at one sweep of the net on leaf of a plant growing in the water at edge of the Suduganga river, on 10th August 1919. Most of the insects were on the underside of the leaf, which was not more than six inches above the water.

Type, allo-type, and ten co-types in my own collection.

MUSCIDÆ.

Idiella euidielloides, sp. nov.

♂♀. *Head*: frontalia black in male, very dark brownish in female. Parafrontalia greyish silvery, with a black spot around the base of each frontal. Male frontalia at narrowest about as wide as first antennal joint, female one-fifth of head. Face and epistome shining, very dark brown. Antennæ black, third joint grey-dusted. Arista black with base yellowish. Rays long. Occiput black, genæ yellow with long soft concolorous hairs, at base of each of which there is a small black dot. Proboscis and palpi black.

Thorax: ground colour of dorsum dark metallic green, with grey pollen, closely covered with black dots, from each of which arises short hair. Viewed from in front there are black median and dorso-central stripes, not at all distinct. Scutellum concolorous with mesonotum, the apical margin shimmering silvery. Pleura whitish yellow, with long soft hairs of same colour, arising from small black dots. Chætotaxy: 4 prescutellars—a humeral—2 notopleural—antreior supra-alar 1—posterior 1-3—(the latter on postalar callus)—2 mesopleural, pteropleural weak—sternopleural 0-1, strong. Scutellars 6.

Abdomen: male dorsum shining dark brown, lateral margins of first, second and third at base yellowish brown, of remainder of third and fourth, including tip of the latter, dark metallic green. Female dorsum with all first and basal half of second segment pale brownish yellow, apical half of second third and fourth dark brown, lateral margins and tip of fourth broadly shining, dark green.

Legs: femora black with dark green metallic reflections, tibiæ yellow, apically darkened to a varying extent, sometimes over all the apical two-thirds, first joint of fore, first two joints of posterior tarsi whitish yellow, remainder black.

Wings: costa infuscated in front of second vein, the band extending, subapically, outwards and downwards to bend of fourth vein, fading away

below, the apex, below tip of fourth vein and exterior to it, clear. Squamæ white, margin of lower somewhat darkened. Halteres orange yellow.

Long 5·5 mm.

Described from a pair (type and allo- type), in good condition, taken on a flower shrub, Shillong, 13th October 1920, by the Imperial Entomologist and a female, in indi ferent condition, on a hedge in the native village, Shillong, on 12th October 1920. All in my own collection.

This species has the small facies of a *Euidiella*, and is very like *quadrinotata* Bigot superficially.

EUIDIELLA DISCOLOR, Fab. var. NIGRIPES. (nov. var.)

♂. *Head*: black, parafacialia with some shimmering silver grey spots: lunule and sides of face except for median triangular patches brownish. Genæ yellow with long yellow hairs. Antennæ, proboscis and palpi blackish, third joint of the former grey-dusted. Arista basally yellow, remainder black, rays few and short.

Thorax: dark green with some greyish pollen and very numerous black spots each bearing a hair, scutellum concolorous, its apical margin narrowly whitish shimmering. Pleura yellow, with long concolorous hairs. Chætotaxy humeral 1: presutural 2: supra-alar 2-3: prescutellar 2: notopleural 2: mesopleural in a fan: sternopleural 1-1: usual hypopleural fan. Scutellars 6.

Abdomen: extreme base black. First three segments dorsally yellow, their hind margins black banded, with a median black stripe greatly broadened on the third. Fourth segment silvery yellow-grey, black spotted, hind margin black. A faint median dark stripe.

Legs: fore coxæ dark grey, superficially appearing black; posterior pairs obscurely brownish. All femora black, fore tibiæ black, posterior pairs dull brown. Fore metatarsus and first three joints of posterior tarsi yellowish, remainder black.

Wings: clear, absolutely without trace of infuscation at tip of second vein. Squamæ and halteres pale yellowish.

Long 7 mm.

Described from a unique male in good condition, taken at Emelina Estate, Maskeliya, Ceylon, between 25th and 29th December 1919. In my own collection.

In a long series of *E. discolor* from various localities in Ceylon and North Bihar, I find the yellow fore coxæ and base of hind femora constant, whether belonging to true *discolor* or form *muscina*, Rondani. Normal specimens occurred in company with this specimen, which, further, is distinctly larger than any such seen by me. I give it, until more material comes to hand, varietal rank only.

Euidiella nila, sp. nov.

♂. *Head*: black, parafacialia with some greyish shimmering spots. Antennæ and proboscis black, third joint of former grey-dusted. Palpi dark brownish. Genæ and a narrow postocular margin whitish grey, the former with long concolorous hairs.

Thorax: very dark blue, with a little whitish pollen and numerous black spots, each bearing a short hair. A median and dorso-central black stripes, indistinct. Scutellum concolorous with mesonotum, with apical margin shimmering silvery. Pleura obscurely blackish with greenish brassy reflections, hairs sparse though long, black, whitish above base of fore coxæ and on sternopleuron. Chætotaxy: humeral 1: presutural 1: supra-alar 2-3: prescutellars 4: notopleural 2: a mesopleural fan: sterno-pleural 1-1: a hypopleural fan. Scutellars 6.

Abdomen: dully shining greenish blue, with grey pollen, the first segment dark, blackish. Second and third broadly black banded on fore and hind margins, and with a median black stripe. Fourth segment similar, but basal band, except laterally, and median stripe narrow.

Legs: fore coxæ black, grey-dusted, posterior pairs yellowish brown. All femora, fore tibiæ and tarsi black, posterior tibiæ and tarsi dark brownish.

Wings: clear, very slightly smoky, but not definitely infuscated except around the humeral cross-vein. Squamæ smoky brown, halteres orange yellow.

Long 6·5 mm.

Described from two males in good condition, taken at flowers, Coonoor, on 25th September 1920

Type and co-type in my own collection.

Metallea flavibasis, sp. nov.

♀. *Head*: frontalia brown above, shading to orange at lunule, containing an elongate triangle of shimmering pale golden pollen, the base of which contains the ocelli, its apex reaching half way down frons. Parafrontalia of a similar shimmering pale golden pollen. Frontal width one-quarter of head, slightly but distinctly more narrowed at vertex than in *notata*. Face yellow with a little grey pollen in sub-antennal depression. Parafacialia continuous and concolorous with parafrontalia. Genæ similar, with white hairs. Epistome shining pale yellow, palpi concolorous, with brown tips, proboscis black. Antennæ orange, third joint white-dusted, arista black with orange base, naked. (Under a high power microscopically pubescent). Occiput black on upper, yellow on lower half. A yellow triangle, its base upmost, from vertex to neck. Upper posterior eye, margins narrowly grey.

Thorax: dorsum metallic green, so thickly dusted with yellow pollen as to hide the ground colour entirely unless rubbed, the whole appearing dull olive instead of the bright green of *notata*, with black spots at the bases of the bristles Scutellum concolorous, pleuræ also, but when rubbed the ground colour appears blackish.

Abdomen: first segment pale yellow, sometimes second and third also, or these two segments reddish brown, their hind margins always narrowly pale yellowish banded. Second segment sometimes with subapical transverse brown flecks towards the sides, third segment with subapical black band sometimes obscure, sometimes clear cut and more greyish, fourth and side margins of second and third grey with black spots from which arise bristles. A median black stripe throughout, sometimes absent on first segment, sometimes broadened T-shape sub-apically (in which case the hind margin is narrowly yellow banded as the next two always are), this stripe interrupted where it crosses the apical yellow bands. Venter yellow, with lateral grey spots, small on second and large on third segment. Fourth all grey.

Legs: coxæ dark grey pollinose, femora yellow, their apical halves blackened to a varying width, the extreme tips yellow: tibiæ yellow, the tips more or less darkened: metatarsi yellow, remainder blackened.

Wings clear, squamæ white, halteres pale yellow.

Long 5–6·5 mm.

Described from twenty-four females all in good condition, taken at Suduganga, Matale, Ceylon in January, March, June, August and October of various years, one at fresh cut earth, remainder on windows. Type and cotypes in my own collection.

Amply distinguished from *notata* (v. d. W.) by the yellow bases of the femora and the entire absence of shining green on the abdomen.

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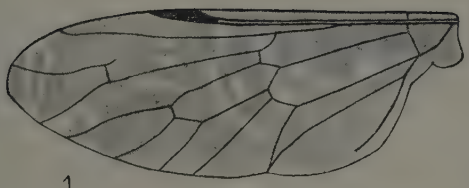

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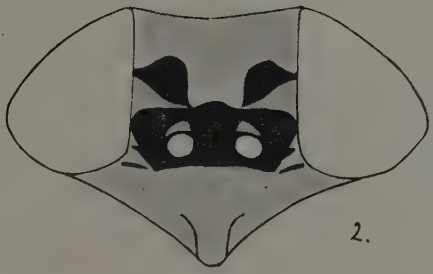

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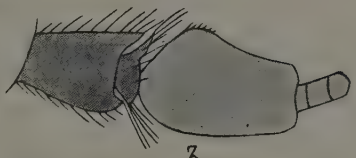

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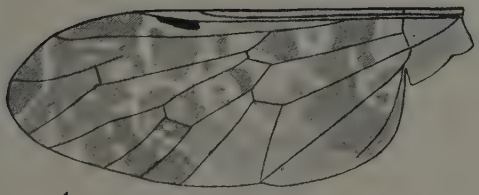

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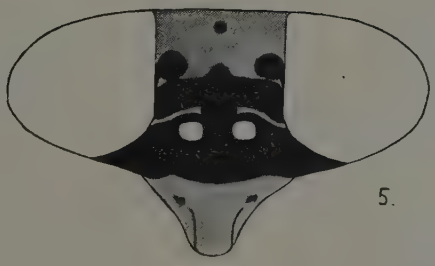

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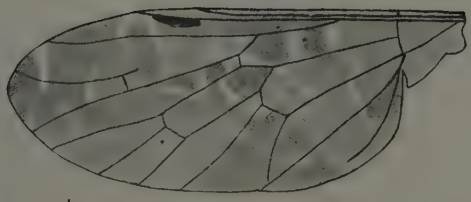

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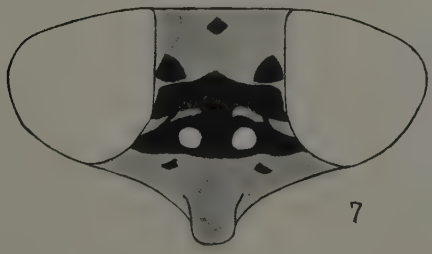

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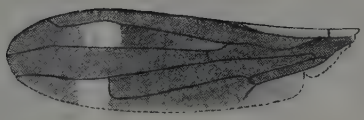
R. S. W. ad nat. del.

Tabanus kakhyenensis. Senior-White.

R. S. W. ad nat. del.

PLATE XII.



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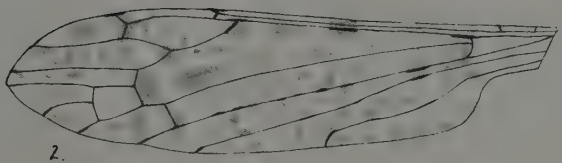

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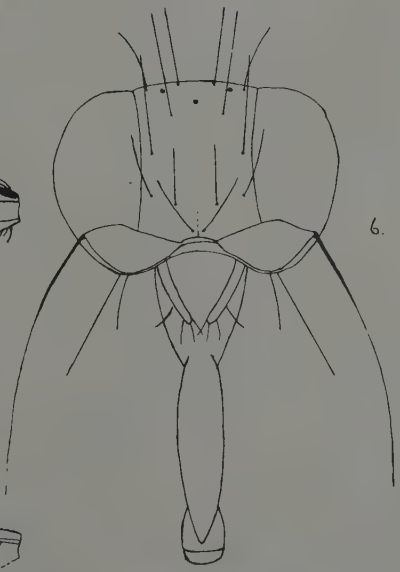

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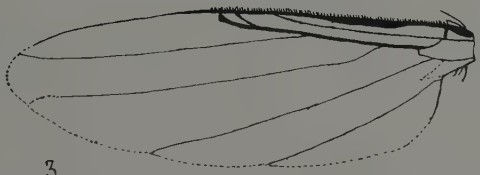

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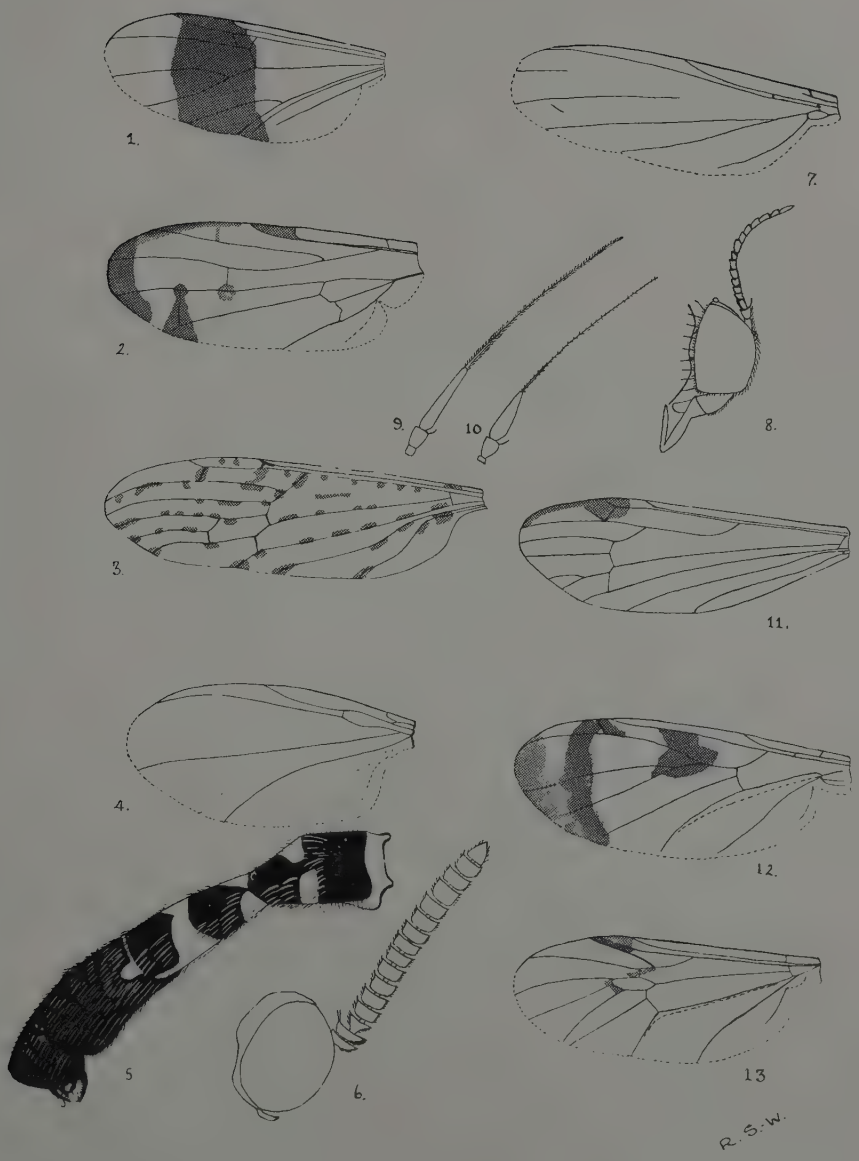

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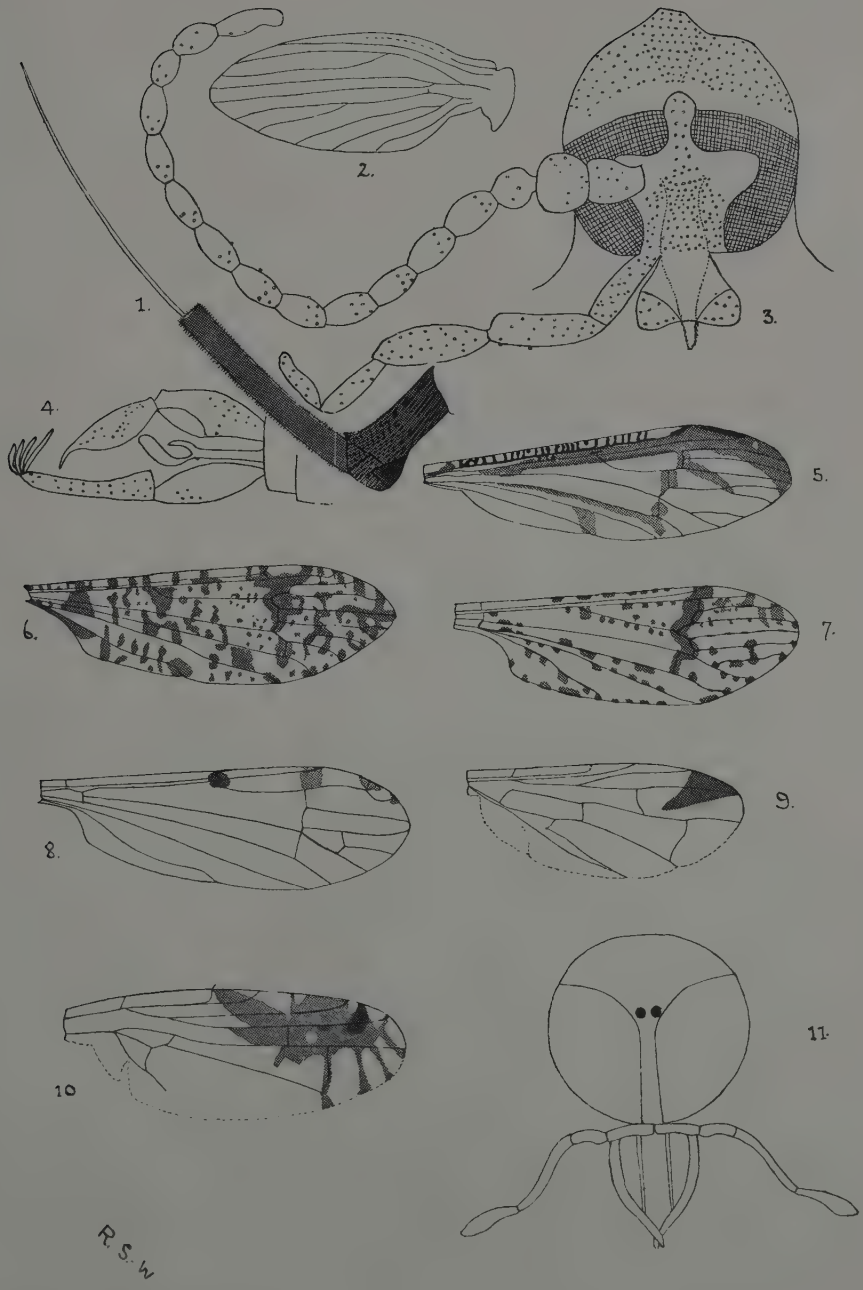
PLATE XV.



R. S. W ad nat. del.

PLATYEDRA GOSSYPIELLA, SAUND., THE PINK BOLL-WORM, IN SOUTH INDIA, 1920-1921.

BY

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[Received for publication on 4th March, 1922.]

THE investigations into the habits of the Pink Boll-worm for the season 1920-21* were a continuation of those started in 1919.[1] They were designed to act as a check on last season's observations and to find if possible some means of calculating in terms of rupees the actual loss likely to be sustained by the *raiyat*. From this should follow some results which would show the extent to which the Pest Act had benefited cotton growers in those districts in which it has been enforced. As was the case last year, no signs of long-cycle larvæ being produced were found, and the infestation of the new crop must come simply from survivors of the last generations produced in the previous year. The problem of how the Pink Boll-worm tides over the dead season even to the small extent of which it is now capable has yet to be elucidated. This paper only gives figures of the rate of increase once the first infestation of the crop has started.

Measurements were made of all larvæ found in cotton bolls. These were grouped under three heads: those under 5 mm. in length, those between 5 and 10, and those over 10 mm. The percentage of these to one another at any time should give an indication of the rapidity with which broods

* All notes on the Pink Boll-worm and *Earias* spp. refer only to the southern districts of the Presidency as practically no work has been done on these pests in the northern cotton tracts.

[1] Ballard, E. "Results of Investigation of Bionomics of *Platyedra gossypiella* (Saunders) in South India." *Proceedings 4th Entomological Meeting, Pusa*, pp. 70–82, t. 13–15 (Dec. 1921).

succeeded one another. A high percentage of −5 larvæ would show that there had recently been a fresh brood and so on. It seemed last year at one time (27th March–8th May) that the length of the larval life was somewhat prolonged, the majority of boll-worms found in green bolls for these five weeks being between 5 and 10 mm. in length, while later on the generations overlapped considerably; from this it seemed that the larval life during the second part of the season (June–August) was shorter. These observations have not been confirmed by the measurements taken this year (1920-21); no such preponderance of +5 larvæ being found between the same dates. It will be seen from Plate XVI, fig. 1, that generations succeeded one another with equal rapidity.[1] Some attention was given to *E. fabia* and *E. insulana* and notes made on the degree of infestation of green bolls and the amount of damage done by them compared to the amount done by the Pink Boll-worm. The results obtained are given in another part of this paper.

Rate of increase in green bolls.

Last season the increase in boll-worm population was calculated from 1,000–2,000 green bolls examined weekly. This year another plan was followed. A field of about 4 acres was placed at my disposal by the Central Farm. The cotton plants in this were divided up into lots of 100 each and all green bolls from one plot were examined weekly, a different plot being taken each week. It was hoped that by this means a fair average for the whole field would be obtained, and at the same time the amount of infestation for Coimbatore District might be estimated, as it was considered to be unlikely that *raiyats'* fields in other parts of the district would be more badly affected.

The plants germinated well, but later on in the season did not flourish and very few bolls were set compared with what might be considered a good average field—many of the plots giving a very uneven yield, the highest number of bolls gathered from any block being only 862 for the "season" and 1,412 for the *kar* or summer picking. Plate XVI, fig. 2 gives the degree of infestation week by week and also the increase in boll-worm population. For the purpose of calculating the latter only actual boll-worms found were counted, and reduced to terms of population per 100 bolls. Plate XVII, fig. 1 gives the same calculations from 1919–20 season. The most striking feature noticed, when comparing the two charts, is that whereas last year, towards the end of the season, *i.e.*, after 8-VII-20, the percentage of population was far higher than the amount of infestation, in this year this was not nearly

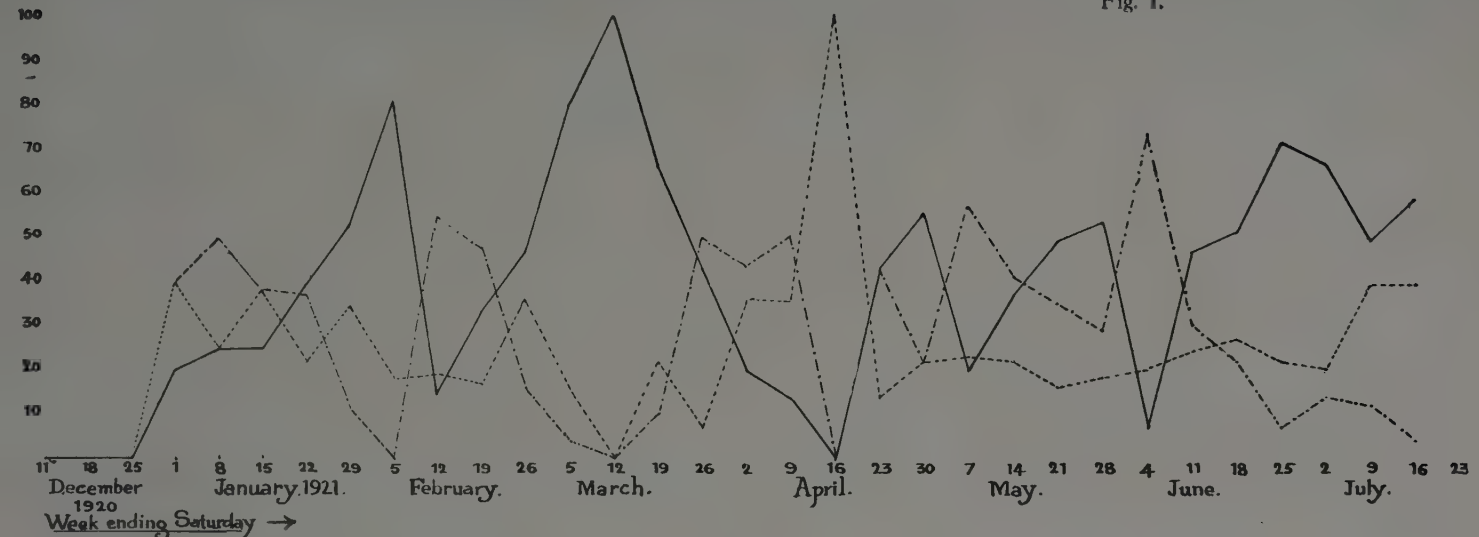
[1] *Ballard, E. ibid.*

Relative percentages of Platyedra larval measurements.

Under 5 mm {-5} ---- Over 5 mm {+5} ····· Over 10 mm {+10} ——

SEASON 1920-1921

Fig. 1.



CAMBODIA COTTON NEW BLOCK CENTRAL FARM

Percentage of population in Green bolls

Earias ····· Platyedra. ——

Percentage of infestation ——·——·——

SEASON 1920-1921.

Fig. 2.

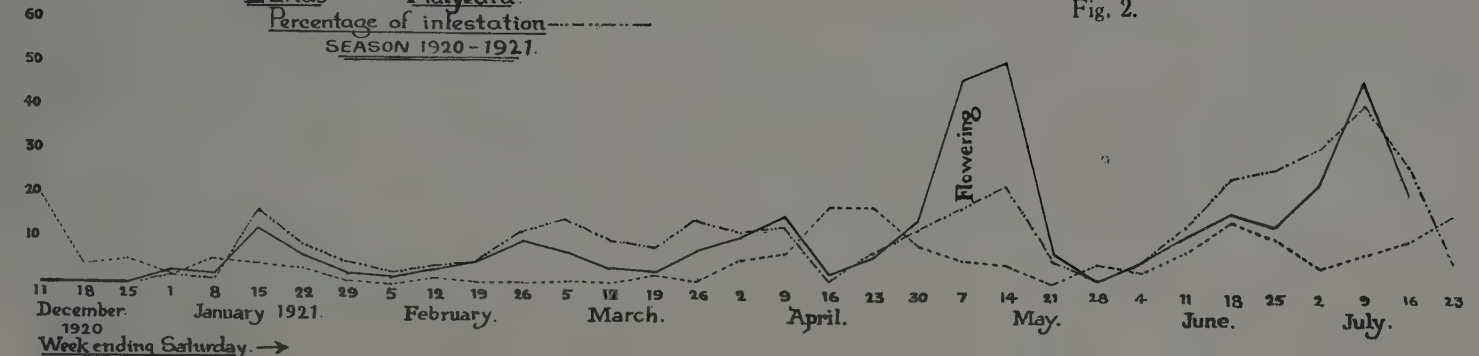


PLATE XI

so marked, the population keeping about the same figure as the boll infestation. It is higher during the interval between first and second crops and rises again at the end of second crop, just before plants were pulled up. The infestation for the same week (second week in July) in the two years is the same.

TABLE I.

Number of bolls set by plots of 100 *plants and degree of infestation.*

11-XII-20—23-VII-21.

No. of plot	No. of green bolls	Infestation	Actual population *Platyedra*	Date	REMARKS
		(Percentage.)			
1	35	..	..	11–XII–20	Very young bolls not examined.
6	104	..	..	18–XII–20	First *Platyedra* eggs found on 17-XII-20.
12	76	...	..	25–XII–20	
18	205	2·44	5	1–I–21	
24	178	2·24	4	8–I–21	
30	209	16·74	27	15–I–21	
36	405	8·64	27	22–I–21	From this week green bolls of all ages were collected.
42	770	4·41	17	29–I–21	
48	862	2·43	11	5–II–21	9 larvæ 10 mm. in length.
54	556	5·57	22	12–II–21	
60	709	5·53	39	19–II–21	
66	354	12·14	36	26–II–21	
72	343	14·86	26	5–III–21	
78	235	10·21	9	12–III–21	All larvæ + 10 mm.
84	340	8·82	9	19–III–21	
90	169	14·79	14	26–III–21	
96	255	12·15	30	2–IV–21	
112	195	13·09	14	9–IV–21	84 examined as remainder were eaten by rats.
118	118	1·53	2	16–IV–21	53 bolls eaten by rats. 65 examined.
124	101	7·92	7	23–IV–21	
130	114	13·15	18	30–IV–21	
136	124	17·74	60	7–V–21	34 —5 mm. Maximum number in one boll 11, 10 of which were —5 mm.
142	148	22·97	76	14–V–21	Maximum in one boll 8
148	648	5·55	51	21–V–21	Maximum in one boll 6.
154	869	2·18	17	28–V–21	
160	1,412	6·30	92	4 –VI–21	69 larvæ—5 mm.
166	604	15·06	71	11–VI–21	
172	343	24 78	59	18–VI–21	
184	593	32·37	140	2–VII–21	92 larvæ +10 mm.
190	300	41·33	141	9–VII–21	Maximum number in one boll 7.
196	106	27·33	23	16–VII–21	Maximum number in one boll 6.
202	108	9·26	7	23–VII–21	Plants all pulled up by 1st August.

After 4-VI-21 young and formed bolls were examined separately. It has been noted that the boll-worm avoids young bolls but prefers those

three-quarters to fully grown. The figures given below support this observation.

TABLE II.

Showing boll-worm population in young bolls and bolls ¾ to fully grown.

Number of bolls	¾ to fully grown	Young	Population	
	a	b	a	b
1,412	470	942	17	3
604	353	251	68	4
349	287	62	56	3
377	357	20	55	..
593	568	25	140	..
300	288	12	141	..
106	57	49	19	4
108	35	73	3	4

DAMAGE TO WHOLE CROP FROM EXPERIMENTAL AREA.

As the crop in the experimental area ripened and picking began, counts were made of the actual damage sustained by the crop. At first the ripe bolls were picked whole from the bushes and brought into the Insectary for examination; later it was found that some were lost and in other cases the *kapas* separated from the capsule. Examination was then made in the field as the crop was picked.

One boll-worm only eats two or three seeds, therefore, as a rule, would only damage one locule, or one lock so far as the destruction of seed is concerned. But in addition to this, the lint is often stained, fungus spores get in through the escape hole made by the mature larva, and threads of the lint are often stuck together. Taking all this into consideration, and also the fact that healthy seeds in an attacked boll are also affected, it was assumed that a locule attacked was to all intents and purposes a locule lost and that its contents were valueless. This is not true in every case and depends on the age of the boll when it was first attacked, but for the purpose of arriving at a rough estimate of the loss to the crop due to Pink Boll-worm it is probably accurate enough. It is calculated that the results obtained give an outside figure and that the actual losses due to Pink Boll-worm fall well inside the estimate made.

In Table III are given the details of examination of ripe bolls from the 4 acres of cotton on the Central Farm, 1920–21. In some ways the figures are unsatisfactory: not only did some stealing of *kapas* take place, but cattle

rom a village just on the boundary of the field, which had been recently acquired, often strayed into the crop and did more damage than many boll-worms. The loss of some *kapas* which fell from the ripe locules also contributes to inaccuracy, but even taking all these factors into consideration the results obtained are not without interest. It may be noted that a boll damaged by *Earias* might at times have been mistaken for one damaged by *Platyedra*, but the effects of the working of the two insects are generally very easily differentiated after a little experience,[1] and it is not likely that very much inaccuracy has crept in owing to the work of the two boll-worms being confused. *Earias* also generally confines its attention to buds and young bolls and in any case is always present in much smaller numbers than the Pink Boll-worm.

TABLE III.

Showing the details of examination of ripe bolls from 4 acres of cotton on Central Farm, 1920-21.

Date	No. of bolls collected	No. of bolls damaged *Platyedra*	No. of locks damaged *Platyedra*	REMARKS
Week ending—				
5–II–21	10,023	4,511	6,300	
12–II–21	8,528	2,692	3,398	
19–II–21	8,596	1,888	2,375½	
26–II–21	13,328	2,369	2,654	
5–III–21	26,904	3,455	3,919½	
12–III–21	25,604	1,728	1,816	
19–III–21	22,469	1,454	1,519½	
26–III–21	11,664	1,071	1,229½	
2–IV–21	8,609	636	730	
9–IV–21	5,340	717	867	
16–IV–21	10,598	2,281	2,102½	
23–IV–21	4,643	1,338	1,346	
30–IV–21	8,050	2,848	3,134½	
7–V–21	3,688	1,504	1,708½	
14–V–21	3,547	1,419	1,665½	
21–V–21	3,693	1,942	2,746	
28–V–21—11–VI–21	Interval between season and *kar* picking.			
18–VI–21	10,970	5,527	9,462	Bolls not picked from West side of field reducing total area by about an acre.
25–VI–21	13,794	4,963	8,088	
2–VII–21	16,776	5,331	8,227½	
9–VII–21	7,617	3,658	6,593½	
16–VII–21	4,876	1,893	3,403½	
23–VII–21	2,402	1,021	2,003	
30–VII–21	793	464	844½	End of season.

[1] Gough, H. L. Nature of damage done by Pink Boll-worm. *Bulletin No. 2, Entomological Section, Cairo* (1916).

Plate XVII, fig. 2, shows the same thing in graphical form, calculated in percentages. From this it will be seen that the percentage of locks destroyed is roughly $\frac{1}{3}$ of the percentage of bolls attacked for the first or season picking, and approximately half for the *kar* picking. From this it follows that for the *kar* picking not only are more bolls actually attacked but also the amount of damage done is proportionately greater for the amount of infestation. Plate XVII fig. 2 also gives the loss due to *Earias*, but that will be referred to again later.

The total number of bolls damaged by *Platyedra* for the season picking was 31,873, out of 1,75,284 bolls collected, that is to say, 12·47 per cent. Out of these 31,873 bolls, with an average of 3·6 locks each (the number of locks in a Cambodia boll varies from 3–5), *i.e.*, 114,741 locks, 36,812 were damaged, that is to say, approximately 33 per cent. of the bolls damaged were a total loss. This makes the damage due to the Pink Boll-worm for the season picking about 4 per cent. As stated above, this figure is, of course, only approximate and represents the maximum loss. It is not claimed that this figure would hold good for the whole Presidency or even for the district as in some parts of Coimbatore the infestation is always lower than on the Central Farm.

For the *kar* picking it was found that the actual loss is a little less than $\frac{1}{2}$ of the percentage infestation. In view of the increase in the boll-worm population as the season progresses some such result might have been expected. For the *kar* picking 57,228 ripe bolls were collected. Of these 22,247 or 39·95 per cent. were damaged by Pink Boll-worm. The 23,857 bolls represent 82,285 locks. Of these 38,622 locks were damaged—this represents 10,728·3 bolls=total loss of 18·7 per cent. or approximately a little less than half the total green boll infestation. The great difference between the loss in the season crop and the *kar* crop is very noticeable. If the *kar* picking is taken as 40 per cent. of the total picking this would mean a loss to the whole crop of 11 per cent. which is probably a fair estimate. It does not however take into account the losses due to *Earias*, or to premature bud-fall due both to *Earias* and to other causes.

A few notes were made on the amount of the food required by one *Platyedra* larva to complete its development. These notes were made in the following way. Attacked bolls were opened and examined seed by seed, the number of seeds totally destroyed was noted, and every escape hole cut was taken as an indication that a larva had been in the boll. The results are tabulated below :—

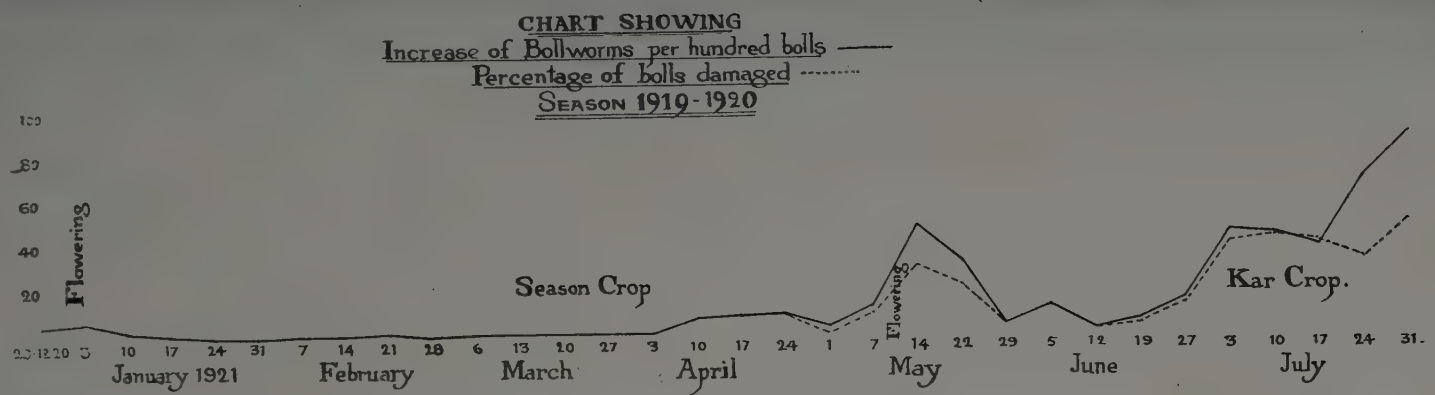


Fig. 1.

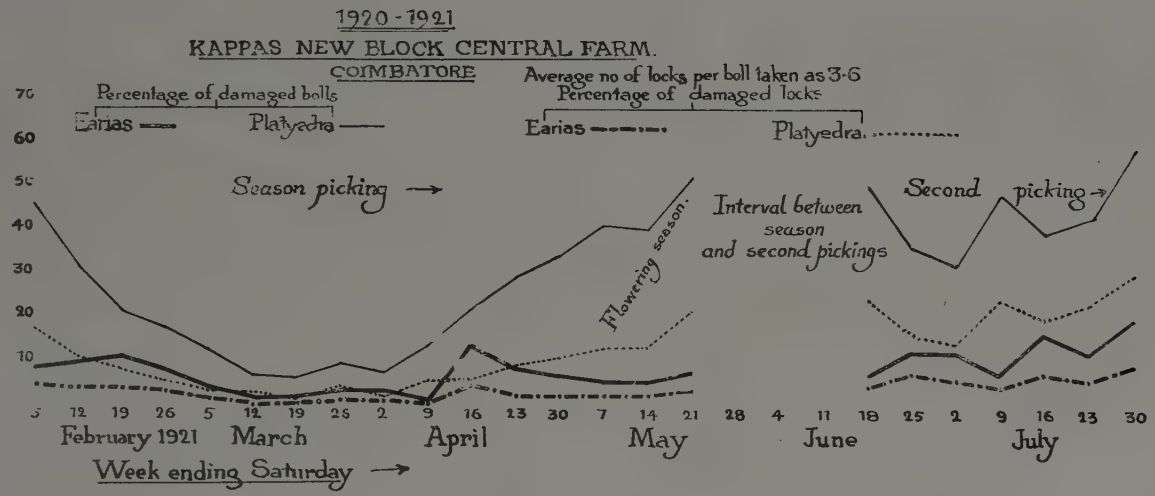


Fig. 2.

PLATE XVII.

Table IV.

Showing the amount of food required by Platyedra larvæ for development.

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	Remarks
1	1 + 10 mm. 1 + 5 mm.	2	4	+	
2	1 + 5 mm.	1	2	—	
3	..	1	4	+	
4	..	1	3	+	2 seeds only nibbled.
5	..	1	3	+	
6	..	1	6	+	
7	2 — 5 mm.	2	2	—	
8	..	2	7	+ (2)	
9	..	3	6	+ (2)	
10	1 + 10 mm.	1	4	—	
11	2 + 10 mm.	2	4	—	These larvæ measured exactly 10 mm.
12	..	1	7	+	
13	2 + 10 mm.	2	4	+	
14	1 + 10 mm.	1	4	—	
15	..	2	5	+	
16	1 — 5 mm.	1	2	—	
17	2 — 5 mm.	1	2	—	
18	1 — 5 mm.	3	9	+ (2)	*Earias* had also damaged this boll.
19	1 + 10 mm.	1	5	+	
20	..	2	6	+	
21	1 + 5 mm.	2	2	—	
22	1 + 10 mm.	1	6	+ (2)	
23	1 + 10 mm.	2	7	+	
24	1 + 5 mm.	½	2	—	One seed only nibbled.
25	..	1	2	+	
26	..	1	3	+ (2)?	*Earias*

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
27	..	½	2	+	
28	..	2½	5	+ (2)	
29	1 + 10 mm.	½	1	—	No staining of *kapas*.
30	..	2	5	+ (2)	
31	..	1	4	+ (2)	Also damaged by *Earias*.
32	..	1	2	+	Lock entirely destroyed.
33	1 + 5 mm.	½	1	..	
34	..	3	9	+	Larva had entered from the top of the boll and although over 5 mm. in length had been feeding on boll wall and had only just began to attack the seed. It was feeding free in the lint.
35	..	1½	8	+	
36	..	1	2	+	
37	1 + 10 mm.	2	5	+	Larva measured exactly 10 mm.
38	..	½ + ½	3	+	
39	..	..	..	..	Boll undamaged by larva making cocoon on bracts.
40	..	1	4	+ (2)	
41	1 + 10 mm.	1	5	+	
42	..	½	1 ? 2	+	Boll attacked by Saprophytic fungus.
43	..	1½	4	+3	
44	1 + 10 mm.	1	4	+	
45	1 + 10 mm.	½ + ½	5	+	Larva had made a cocoon by rolling up a leaf in the cage.
46	..	1	1	+	Boll only half-grown.
47	1 + 10 mm.	½ + ½	3	+ (2)	Two holes in two different locks. In one locule two seeds damaged, in the other fully fed larva inside a seed. Suggested that 2nd "Escape hole" was an entrance hole. This in my opinion is very doubtful.
48	..	½ + ½	4	+ (2)	One seed eaten in one locule, two in another.

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
49	1 + 10 mm. 1 + 5 mm.	½+½+½	5	+2	3 seeds eaten in one locule, one in each of the others.
50	1 + 10 mm. 1 + 5 mm.	½ + ½	4	—	3 seeds eaten in one locule, one in each of the others. The small larva had eaten through the septum dividing two locks.
51	..	½ + ½	5	+ (2)	
52	..	½ + ½	4	+ (2)	
53	1 + 10 mm.	All	..	+ (2)	Boll was ½ in diameter and completely destroyed.
54	..	2	5	+ (2)	
55	..	½ + ½	2	+? 2	Doubtful whether one or two larvæ had been in hole. But probably only one.
56	1 + 10 mm.	..	4	+	One escape hole half-made, one complete.
57	..	..	5	+ 2	
58	..	..	..	—	*Earias* eating boll rind.
59	1 + 10 mm. 1 — 5 mm.	2	4	—	3 seeds eaten by larva.
60	2 + 5 1 + 10	3	9	+ 4	One lock attacked by fungus.
61	1 + 5	2	2	+ (2)	
62	..	4	6	+ 3	
63	1 + 10 3 + 5 1 — 5	3	9	+ 2	
64	1 + 10 10 — 5	3	9	+	
65	1 + 10 mm.	2	6	+ 2	
66	1 + 5 mm.	1	2	+ 2	
37	6 (-5) mm.	3	6	+	
68	1 (5) mm.	2	3	+	

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
69	1 (+ 5) 3 (+ 10)	3	6	+	Whole boll destroyed by *Earias* ?
70	1 + 10 3 + 5	2	6	+	+ 10 larva parasitized; escape hole half-made.
71	1 + 5	1	2	—	
72	1 (+ 10)	3	9	+ (3)	Larva parasitized.
73	..	4	8	+ (3)	
74	1 + 10	4	6	+	Locks all partially damaged. Larva parasitized.
75	1 + 10 1 + 5	4	6	+ (2)	
76	1 + 5	1	2	—	Seeds attacked but not eaten entirely.
77	..	..	..	—	Attacked by bacteria.
78	1 + 10 1 + 5	3	8	+ (2)	
79	..	..	..	—	Unidentified larva had eaten a large hole from base of boll. No damage inside.
80	..	½ + ½	4	+ (2)	
81	..	1	4	+	
82	1 + 10 1 — 5	2	7	+ (2)	
83	..	All locks showed damage	10	+ (4)	
84	damaged by fungus	4	..	+	
85	..	1	4	+	
86	..	1	..	..	Whole of one lock destroyed either by *Earias or Platyedra.*
87	..	1	8	+	Two seeds were only damaged above the side.

TABLE IV—*concld.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
88	..	2	5	+ (2)	Two seeds entirely destroyed; 3 nibbled seeds completely eaten, each at the top of a locule.
89	..	½ + ½	2	+	
90	..	..	..	—	Small *Earias* just boring in.
91	..	3	8	+ (2)	
92	..	..	..	—	Young *Earias* tunnelling in boll wall.
93	..	1	2	+	
94	..	1	8	+ (2)	Badly attacked by Saprophytic fungus.
95	..	2	4 ? (5)	+	
96	2 +5 mm.	3	10	+ (4)	Do.
97	..	1	4	+	
98	1 +5 mm. 2 +10 mm.	..	..	—	Lost count of seeds.
99	1 —5 mm.	2+½+½	..	+	One larva found just under 5 mm. tunnelling in lint but had not damaged any seed.
100	..	1	3 + 1	..	One damaged by *Earias*.
101	..	1	6	+ (2)	
102	..	½	2	+	Saprophytic fungus in boll.

224 larvæ had destroyed partially or entirely 356 seeds. Of these larvæ 51 were recently hatched or only half-grown. So it would appear that not more than three seeds are required to feed a larva. The average would be about 2, provided that the boll was fairly well-grown at the time of attack. As has been often stated before, *Platyedra* usually avoids young bolls. In this connection it might be noted that *Platyedra* early in the season lays its eggs on flowers and prefers apparently those blooms which are fertilized and beginning to wither. Recently laid eggs were found in fertilized flowers on 17-XII-20. The first boll-worms were not found in bolls until the week ending 1-I-21. At the time when eggs were found on the flowers there were young maturing bolls in the field, but not in any great number (Table I).

Examination of seeds and bolls for the existence of long-cycle larvæ.

Green bolls were collected from the Central Farm on 2-VIII-21. These gave 1,118 moths between 2-VIII-20 and 4-IX-20 of which the great majority came out by 25-VIII-20. In addition to these, two were caught on 20-IX-20.

These bolls were examined on 28-I-21 ; many seeds showed pupal cases either inside them or half pushed out of the hole made by the entrance of the larva. No larvæ were found with the exception of one which was dead.

The remainder were examined on 1-III-21. One double seed was found containing a dead larva, one or two seeds with no larvæ and numerous pupal cases.

There seems to be little doubt that long-cycle larvæ do not occur in South India.

Kapas store Central Farm Summer picking, 1920.

Between 16-VII-20 and 15-VIII-20 a light trap was put in the *kapas* store on the Central Farm. Between 16-VII-20 and 15-VIII-20, 1,335 moths emerged, the highest catch being 138 on 30-VII-20. No more were caught after that date and the store was cleared from *kapas* and seed purchased locally, probably mixed first and second picking. Between 16-X-20 and 2-XI-20, 62 moths emerged, the highest catch on any day being three.

Comparison of attack by *Platyedra* in area under the Pest Act and areas outside its jurisdiction.

The Pest Act was extended in 1920 to cover all Coimbatore District with the exception of Kollegal, Trichengode in Salem District, Karur, Kulitalai and Manaparai in Trichinopoly District, and the *taluqs* of Dindigul and Periakulam in Madura District. All Cambodia cotton was supposed to be pulled up by 1st August. This ideal was not attained but all cotton was out by the end of the month except in those cases where false returns had been submitted.

Arrangements were made with the Deputy Directors of Agriculture to send in weekly consignments of green bolls from different places in their circles. Some 100–300 bolls were sent weekly. The results of the examinations of these bolls are given below (Table V) :—

TABLE V.

(A) *Infestation of bolls from Pest Act area.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual Population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
Coimbatore District. Avanashi Taluq.						
26-II-21	207	1·96	3	1·44	..	All cotton pulled up after the first picking.
5-III-21	102	3·92	3	·98	..	
12-III-21	103	0·97	..	..	..	
19-III-21	105	6·60	1	1·90	..	
26-III-21	120	6·60	3	4·10	2	
2-IV-21	189	8·31	8	1·14	1	
9-IV-21	110	16·36	8	2·72	..	
16-IV-21	115	30·43	34	2·60	1	
23-IV-21	110	50	42	2·72	1	
30-IV-21	107	41·12	79	4·67	..	
7-V-21	100	43	54	1·00	..	
14-V-21	106	70·75*	287	1·88	2	
Coimbatore District, Palladam Taluq.						
19-II-21	116	12·06	6	0·86	1	
26-II-21	349	7·26	29	2·24	1	
5-III-21	323	6·40	23	0·98	2	
12-III-21	208	6·70	9	..	..	
19-III-21	422	7·28	10	2·57	4	
26-III-21	212	7·96	9	0·81	1	
2-IV-21	303	9·38	24	2·77	2	
9-IV-21	287	18·86	42	4·04	1	
16-IV-21	289	33·90	106	3·75	4	
23-IV-21	204	41·66	69	9·8	4	
30-IV-21	208	49·12	186	2·38	..	
11-VI-21	101	24·75	15	0·99	1	
25-VI-21	103	17·47	8	6·79	6	
2-VII-21	95	16·84	3	..	..	
9-VII-21	108	39·87	21	5·55	2	Average for Coimbatore District including Central Farm 19·09.

Average infestation for season 19·9 per cent.

* As the season picking is over by this date and there are very few green bolls it is doubtful whether this figure should be included in the average.

TABLE V—*contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Madura District, Dindigul Taluq.			
12–III–21	96	22·91	33	3·12	1	Bolls from Dindigul and Palani mixed in transit.
19–III–21	50	38·00	33	2	1	
26–III–21	100	24·00	17	5	..	Boll also attacked by *Platyedra.*
2–IV–21	160	36·91	79	0·5	..	One lot of bolls a long time in transit.
9–IV–21	101	70·29	102	2·97	2	
16–IV–21	104	26·29	18	25·96	9	
7–V–21	100	36·00	30	..	..	
14–V–21	101	86·13*	198	2·97	6	
21–V–21	101	37·62	27	..	..	
27–V–21	97	30·92	26	..	..	
4–VI–21	190	46·00	60	..	..	
25–VI–21	99	13·13	5	..	..	
2–VII–21	100	18·5	40	..	..	
9–VII–21	99	58·58	68	..	..	Excluding week 14-V-21 which was abnormal owing to there being very few bolls in the fields from which consignments were collected.
			Madura District, Nilakottai Taluq.			
11–VI–21	100	39	48	2	2	
18–VI–21	100	56	85	3	3	
			Palani Taluq.			
12–III–21	96†	22·91	33	3·12	1	
19–III–21	50	58·00	24	8·00	4	
28–V–21	109	46·78	47	1·83	1	
			Periakulam Taluq.			
12–III–21	99	5·05	3	3·03	2	
19–III–21	101	12·87	2	3·96	4	
26–III–21	100	14·00	13	4·00	1	
9–IV–21	100	48·00	61	6·00	2	
16–IV–21	101	27·72	16	27·72	5	
14–V–21	98	85·71‡	196	8·16	4	
28–V–21	100	29·00	43	2·00	2	
11–VI–21	75	40·00	14	4·00	1	
18–VI–21	100	25·00	18	9·00	7	
2–VII–21	98	30·61	21	6·12	1	

Average infestation for whole season for this *taluq* 45·89 per cent.

The average for the season for these *taluqs* of Madura District in which the Pest Act was enforced is 39 per cent.

* Picking over, very few bolls in those fields. They do not therefore represent an average attack.

† Bolls from Palani and Dindigul *taluqs* which adjoin were mixed in transit.

‡ Picking over in this field, bolls very few.

TABLE V.—*contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent *Earias*	Population *Earias*	REMARKS
			Salem District, Omalur Taluq.			
26-III-21	107	0·93	..	3·73	3	
2-IV-21	109	36·69	43	2·74	2	
			Salem Taluq.			
26-III-21	100	..	..	6·00	1	
12-III-21	110	10·9	4	2·72	2	
			Trichengode Taluq.			
26-II-21	105	1·9	2	..	..	

Average for Salem District 3·85 for months February and March.

			Trichinopoly District, Karur Taluq.			
9-IV 21	119	36·13	65	2·52	..	These bolls were collected from fields in which picking was in progress. In the vicinity the crop had been removed before May. These figures are not reliable therefore and could not be included when making out general average for area under Pest Act.
21-V-21	250	80·00	202	3·60	3	
			Kultialai Taluq.			
26-III-21	100	4·0	2	13·0	7	Only consignment received from this part.

An examination of a crop was made in this *taluq* in the middle of August. Infestation was 40 per cent.

			Musuri Taluq.			
2-VII-21	167	34·13	63	2·99	..	Only consignment received from this *taluq.*

(B) *Bolls from* Taluqs *not under the Pest Act.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			North Arcot District.			
12-III-21	203	49·75	53	1·97	1	
26-III-21	140	25·71	14	0·70	1	
30-IV-21	106	8·49	1	2·83	..	

TABLE V.—*concld.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Vellore—North Arcot.			
5–III–21	195	5·04	4	26·15	23	Cambodia cotton only recently introduced.
19–III–21	201	11·44	2	..	..	
30–IV–21	200	32·50	27	4·00	2	
			Madura District, Tirumangalam Taluq.			
12–III–21	200	32·50	30	2·00	6	
19–III–21	200	41·00	131	2·00	13	
26–III–21	200	42·00	108	2·50	10	
2–IV–21	200	48·50	207	3·00	1	
9–IV–21	199	50·25	29	1·05	1	Some larvæ eaten by ants in transit.
16–IV–21	200	32·50	53	0·17	3	
23–IV–21	189	64·02	273	0·52	..	
30–IV–21	200	74·50	424	0·50	1	
7–V–21	200	61·00	171	2·50	5	
14–V–21	200	68·00	191	3·50	..	
21–V–21	195	38·97	49	6·66	1	
28–V–21	200	36·50	61	4·00	..	
4–VI–21	200	29·00	11	3·50	1	
11–VI–21	201	8·45	3	3·98	2	
18–VI–21	200	17·00	4	6·00	..	
25–VI–21	200	14·50	11	6·50	1	
2–VII–21	200	20·50	17	5·00	3	
9–VII–21	200	41·50	62	1·50	..	
			Average infestation for season		40·03.	

Unfortunately a complete series of bolls was only obtained from one *taluq* outside the Pest Act area. The figures might however be compared with those from the same districts last year when the Pest Act had been enforced only in Coimbatore District.

Date	Area	Attack in 1920	Attack in 1921
		per cent.	per cent.
17–VII–20	Virudupatti, Ramnad District	42·9	34–40
3–VII–20	Dindigul tract	80·9	18·5
5–VI–20	Salem	68·0	No details for this month.

Coimbatore District, where the Pest Act has been enforced since 1919 but which showed boll infestation of 75–84 per cent. in that year, at the end of the season in 1920 showed a maximum of 55·5 per cent., and in 1921 a maximum of 41 per cent. From these figures, although they are not by any means as complete as might be desired, it may be concluded that the pulling out

of Cambodia by a certain date, so as to leave a definite dead season between each crop has been attended by satisfactory results. At Tiruppur, the great cotton ginning and buying centre in Coimbotore District, the opinion of buyers is unanimous that the quality of the cotton since the introduction of the Act has improved. They are all in favour of its being continued. The details of boll infestation not being a complete series from every *taluq*, for purposes of comparison one should select certain weeks and compare them with the same week in other districts and with the same district in previous years.

The actual application of the Act is by no means as satisfactory as could be desired. They are only too many factors calculated to nullify the good effects of its strict enforcement. False returns are sent in stating that all cotton has been pulled up when that is not the case. Sometimes fields sown with Cambodia are not shown in the village accounts, especially if the owner is rich or influential. There is much delay in pulling out the cotton even when it is pulled out and, except in the case of irrigated cotton, it is very rarely that it is out by the appointed date, 1st August. In time, when both the *raiyats* and the Village Officers are accustomed to the Act, its application will be much more efficient. In addition to trouble with the Village Officers there is the usual difficulty created by alarmists who spread wonderful tales as to the real motives which inspired the Act. For example, certain helpful persons, non-co-operators, put it about that the idea of the Act was to restrict the growing of cotton, and to discourage the *raiyats* so that no home spun and woven cloth could be used. The *raiyats* would thus be forced to buy imported cloth. Others had an idea that by pulling up cotton by 1st August plague would be prevented. Others again thought the Government wished to prevent cotton being grown, and there is no doubt that the area of Cambodia cotton was much reduced in some places in consequence. The *raiyat* appears to find it difficult to believe that any Act could be brought in for his own benefit and there are only too many people going about nowadays ready and anxious to provide him with some other theory of the idea underlying the Pest Act, the "Satanic Government" being credited with all kinds of wicked motives!

In spite of all this the continued strict enforcement of the Act is necessary. It may have to be amended in some ways to suit peculiar conditions in different areas. In a country where consideration and mercy are almost invariably looked upon as weakness great care has to be exercised in giving concessions by extending the date by which the crop must be out of the ground so that, when a certain date has been decided upon for a particular tract, the provisions of the Act should be enforced with the utmost vigour. On the whole it cannot be said that the Act is popular with the *raiyats*, but as the majority of them

cannot be expected to know what is good for them, the fact of its unpopularity should not prevent its continuance.

Only one examination of Karunganni cotton (*Gossypium obtusifolium*) was made this year. This was from a field on the Central Farm. 200 green bolls contained 4 larvæ and a 3·5 per cent. infestation. The examination was made on 25-VI-21, when fields of Cambodia were attacked 24–30 per cent.

Earias insulana and Earias fabia.

The numbers of *Earias* spp. in a field at a given time are always very much less than those of *Platyedra gossypiella*. At the same time, an individual *Earias* larva does far more damage than does a Pink Boll-worm. *Earias* larvæ wander from boll to boll, destroy buds and young bolls, and by the holes they make in grown bolls when they attack them, provide an entrance for fungi and bacteria. If *Earias* were as prevalent as *Platyedra* it would be a very serious pest indeed. As it is, in spite of the damage done to buds, tops, shoots and bolls, I do not look on it as a pest of the first order except in certain parts of the Presidency, *e.g.*, in Tinnevelly, where it is a much more serious pest than *Platyedra*.

Table VI shows the relative increase and damage done by *Earias* spp. on the Central Farm during 1920–21.

Plate XVI, fig. 2 shows the same thing in graphical form.

Table VI.

Green bolls from 100 plants.

11-XII-20 –23-VII-21.

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	Remarks
1	35	34·28	7	11–XII–20	
6	104	4·90	5	18–XII–20	
12	76	5·25	4	25–XII–20	
18	205	2·92	4	1–I–21	
24	178	9·56	10	8–I–21	
30	209	4·78	9	15–I–21	
36	405	6·33	16	22–I–21	
42	770	3·37	4	29–I–21	
48	862	1·50	..	5–II–21	
54	556	2·33	7	12–II–21	
60	709	0·84	6	19–II–21	
66	354	0·84	1	26–II–21	
72	343	1·45	3	5–III–21	
78	235	0·85	1	12–III–21	
84	340	2·64	8	19–III–21	
90	169	1·77	2	26–III–21	

TABLE VI.—*concld.*

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	REMARKS
96	255	7·05	16	2–IV–21	
112	84*	11·9	6	9–IV–21	195* } Bolls collected, some eaten by
118	65*	18·46	12	16–IV–21	118* } rats.
124	101	23·76	18	23–IV–21	
130	114	12·28	11	30–IV–21	
136	124	8·06	7	7–V–21	
142	148	6·08	7	14–V–21	
148	148	3·39	7	21–V–21	
154	869	7·94	48	28–V–21	
160	1,412	4·10	58	4–VI–21	
166	604	12·25	52	11–VI–21	
172	343	18·07	51	18–VI–21	
178	377	21·48	44	25–VI–21	
184	593	7·41	28	2–VII–21	
190	300	11·33	26	9–VII–21	
196	104	18·66	12	16–VII–21	
202	108	17·59	10	23–VII–21	

TABLE VI A.

Damage done in dry ripe bolls at the time of picking.

Date	No. of bolls gathered	Bolls damaged by *Earias*	Locks damaged by *Earias*	REMARKS
		Season Picking.		
5–II–21	10,023	825	1,643½	
12–II–21	8,528	821	1,293	
19–II–21	8,596	942	1,376	
26–II–21	13,328	1,123	1,783½	
5–III–21	26,904	1,085	1,379½	
12–III–21	25,604	287	348	
19–III–21	22,469	464	486	
26–III–21	11,664	346	338	
2–IV–21	8,609	222	233½	
9–IV–21	5,340	51	61	
16–IV–21	10,598	1,427	1,746½	
23–IV–21	4,643	360	481	
30–IV–21	8,050	451	678½	
7–V–21	3,688	197	279½	
14–V–21	3,547	194	288	
21–V–21	3,698	258	421	
		Kar *picking season.*		
18–VI–21	10,970	779	1,500	
25–VI–21	13,794	1,500	3,444½	
2–VII–21	16,776	2,001	3,295	
9–VII–21	7,617	581	1,122	
16–VII–21	4,876	775	1,313	
23–VII–21	2,402	270	503½	
30–VII–21	793	140	251	

Percentage of dry bolls damaged for season picking .. 5·16
„ „ „ *kar* „ .. 10·90

Actual damage .. 12736·5 locks = 3536·8 bolls = 2·01% season picking.
„ „ 11427 „ = 3063 „ = 5·3 % *kar* „

From this it will be seen that damage done by *Earias* is approximately half the green boll infestation as compared with one-third for *Platyedra* for season picking and half for *kar* picking.

On the same basis, taking season picking to be 60 per cent. of the total picking and if the figures for the Central Farm are more or less typical for the District, *Earias* damaged 3·32 per cent. of the total crop compared with 11 per cent. loss due to *Platyedra* or 14 per cent. loss of the crop due to both boll-worms.

All the above figures deal with bolls which had set and ripened. *Earias* does most havoc among buds and very young bolls, and also to the top shoots of the plants, causing in some cases much deformity. In Table VII are given the figures for the number of bolls and buds shed by 100 plants in one plot (No. 86) during the season.

TABLE VII.

Buds and bolls shed by 100 plants in Plot No. 86.

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-XII-20 ..	81	..	67	14	The great majority of bolls were young ones of maximum diameter 5 cm.
18-XII-20 ..	66	1	58	7	
25-XII-20 ..	43	..	21	22	
1-I-21 ..	16	4	2	10	
8-I-21 ..	38	2	20	16	
15-I-21 ..	66	4	49	13	
22-I-21 ..	101	3	28	70	
29-I-21 ..	387	3	10	374	
5-II-21 ..	328	5	3	320	
12-II-21 ..	319	3	3	313	
19-II-21	336	3	7	320	

TABLE VII—*contd.*

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
26–II–21 ..	204	1	8	195	Figures for buds and young bolls given separately after this date.
5–III–21 ..	Buds 13	..	4	9	
	Bolls 72	..	4	68	
12–III–21 ..	Buds 26	..	1	25	
	Bolls 85	..	..	85	
19–III–21 ..	Buds 27	..	2	25	
	Bolls 114	..	15	99	
26–III–21 ..	Buds 21	4	5	12	
	Bolls 94	3	24	67	
2–IV–21 ..	Buds 25	1	3	21	
	Bolls 203	..	13	90	
9–IV–21 ..	Buds 3	..	..	3	
	Bolls 54	..	8	46	
16–IV–21 ..	Buds 26	1 ?	11	14	
	Bolls 37	1	12	24	
23–IV–21 ..	Buds 5	..	2	3	
	Bolls 6	1	2	3	
30–IV–21 ..	Buds 19	..	9	10	
	Bolls 34	4	2	28	
7–V–21 ..	Buds 76	13	33	30	
	Bolls 96	16	17	63	
14–V–21 ..	Buds 81	2	55	27	
	Bolls 211	7	107	97	
21–V–21 ..	Buds 125	33	79	13	
	Bolls 515	52	258	205	
28–V–21 ..	Buds 65	..	38	27	
	Bolls 550	20	116	414	
4–VI–21 ..	Buds 58	8	27	23	
	Bolls 414	9	81	324	

TABLE VII—*concld.*

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-VI-21 ..	Buds 28	12	12	4	
	Bolls 106	10	20	76	
18-VI-21 ..	Buds 10	1	6	3	
	Bolls 45	5	18	22	
25-VI-21 ..	Buds 5	1	2	2	
	Bolls 38	5	11	24	
2-VII-21 ..	Buds 4	..	4	1	
	Bolls 3	..	2	..	
9-VII-21 ..	Buds 30	1	29	..	
	Bolls 26	8	17	..	
16-VII-21 ..	Buds 87	10 ? *	73	4	
	Bolls 42	1	33	8	
23-VII-21 ..	Buds 45	2	41	2	
	Bolls 23	..	22	1 ?	

* Probably damaged by young *Earias*.

During the season the hundred plants in Plot 86 shed 4,168 bolls and buds. Of these shedding of 991 was due to *Earias* attack and 258 to *Platyedra* of which 11 are doubtful. The remainder dropped owing to bacterial infection or purely physiological causes (Plate XVIII).

SUMMARY.

1. Figures obtained this year seem to indicate that the actual loss sustained by a cotton crop from *Platyedra* during the season picking is $\frac{1}{3}$ of the boll infestation and during the *kar* picking $\frac{1}{2}$.

2. *Earias* is a much less important pest although one larva does more damage than one *Platyedra* larva.

3. Loss due to *Earias* may be roughly estimated at $\frac{1}{2}$ the boll infestation.

4. Examination of entire crop from a field about 4 acres showed the loss due to Pink Boll-worm to be 11 per cent. and *Earias* spp. 3 per cent.

CHART SHOWING

Relative percentages of causes leading to bud and boll fall.

From 100 plants in plot No 86. New Block Central area. Central Farm. Coimbatore.

SEASON 1920-1921

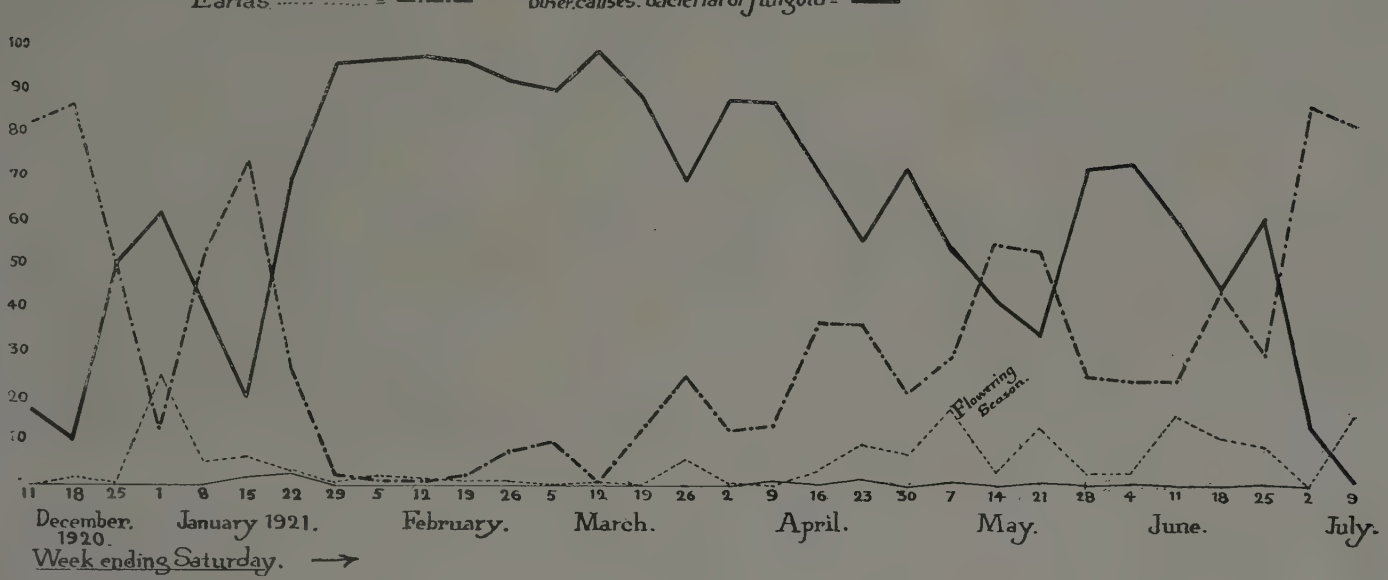


PLATE XVIII.

5. The enforcement of the Pest Act has been attended by good results and should be continued.

6. Figures are given showing how much bud and young boll shedding is due to *Earias* and *Platyedra*.

7. Figures are also given which show that one *Platyedra* larva needs one to three seeds to complete its development.

8. The "long-cycle" *Platyedra* larvæ do not occur in South India.

9. The increase in green boll infestation on Central Farm and in various districts is shown in the tables.

STUDIES IN INDIAN DERMAPTERA.

BY

MORGAN HEBARD.

[Received for publication on the 10th March 1922.]

RECENTLY, all of the undetermined Dermaptera belonging to the Agricultural Research Institute at Pusa, Bihar, India, were sent to us for study by the Imperial Entomologist, Mr. T. Bainbrigge Fletcher. Through his kindness the author has been permitted to retain the holotypes and unique specimens, returning a second set of the material to that Institution.

To the collection to be studied was added material belonging to the author, received from Father C. Leigh, S.J., of St. Joseph's College, Trichinopoly, and from Mr. Andrew Prabala Nathan of Coimbatore, as well as a few specimens belonging to the Museum of Comparative Zoology at Cambridge, Massachusetts. The total forms a larger and more varied Indian series of earwigs than has been studied since Burr prepared his report on Dermaptera for the Fauna of British India.

A great number of localities are represented, evidently situated in many very distinct life zones. It appears, however, that no single locality has yielded more than a small percentage of the total number of forms which there almost certainly occur. This is partially owing to the fact that the collecting of Dermaptera is difficult, due to the secretive habits of the majority of the species and the great diversity of habitat.

Certain species are to be found only under moist bark, others under stones still others in flowers and some in the seed pods of plants or under decaying fruit. Many species are, moreover, comparatively scarce. These factors have resulted, as is usual, in many of the species being represented by uniques or but one or two specimens in the collections before us. Some species, however, come to light and it has often been found more easy to secure large series there than by searching for them in their normal habitat.

Three hundred and ninety-two specimens are here recorded. These represent twenty-nine genera and forty-four species, of which two genera and ten species are described as new. Burr has reported, in all, forty-two genera

and ninety-five species, now recognized as valid, from this territory (which does not include Ceylon or Burma), the present paper bringing the total to forty-four genera and one hundred and eight species. One of the new species here described is not included in this total as it is from Burma. Ceylon and Burma are very rich in Dermaptera, as is shown by the fact that Burr, including these regions in the Fauna of British India, there records fifty-one genera and one hundred and thirty-three species, to which total several subsequent additions have been made.

The territory covered is so vast and varied that it is probable that many undescribed species will still be found. The student must consider undetermined material, however, with exceptional care, owing to the great variability shown by certain species.

In the preparation of the present paper we have been particularly interested in finding that the contrast between the brachylabic and macrolabic phases of certain species is not only manifested by differences in the male forceps but also by changes in the pygidium, ultimate tergite and even by slight differences of proportion in the pronotum as well. As a result, the contrast between the phases developed in such species as *Labidura riparia*, *Exypnus koorgensis*, *Proreus melanocephalus*, *Forficula schlagintweiti*, *Forficula acris* and others, would easily lead one to suppose that in each case two very distinct species were represented. Consideration of the sum total of characters and, in some cases, intergradation proven by large series, has made possible the proper association of the extremes developed in these species.

We have found that, for the majority of the described species, very few and inaccurate measurements have been given. We have, therefore, in the present study, given the essential measurements for many of the less well-known or variable species. These measurements have been taken with the aid of a micrometer. This we find the only safe method of securing measurements sufficiently accurate to show the actual proportions of insects as small as are many of the earwigs.

DERMAPTERA.

PYGIDICRANIDÆ.

Diplatyinæ.

Diplatys bicoloripes, new species. (Plate XIX, figs. 1 and 2.)

This species is closely related to *D. gladiator* Burr, described from Calcutta [and also recorded from Chota Nagpur and Coimbatore, T. B. F.]. It agrees

in having abortive wings, concealed by the tegmina, which are no longer than the width across their shoulders ; in the general cephalic contour ; in the strongly dilated ultimate tergite of the male, and the depressed and dilated male forceps.

It differs in the strikingly bicolored femora, the appreciably concave distal margin of the penultimate sternite and in the forceps, which are quite as strongly bowed as in *D. falcatus* Burr.

In the present insect the forceps have the dorsal surface proximad, toward the external margin, produced dorsad in a stout conical projection ; a feature not mentioned in the descriptions of the two species to which it clearly shows nearest relationship.

Type : male ; Nagpur, Central Provinces, India ; 17th January 1919. (Y. R. Rao.) [Hebard Collection, Type No. 772.]

Size small, form slender, with distal extremity of abdomen much enlarged; as in *gladiator*. Head decidedly wider than pronotum, slightly wider than width across tegminal shoulders : postocular keels weak, sutures distinct, a weak ridge present on each side of median suture ; occiput flattened, but not at all concave. Antennæ with 19 segments, third segment three-quarters as long as the short first segment, fourth about three-quarters as long as third, fifth intermediate in length between these.

Pronotum very slightly longer than wide ; lateral margins convex and converging very slightly caudad, caudal margin truncate and rounding broadly into the lateral margins ; prozona flattened convex, showing a linear mediolongitudinal sulcus, remaining portions depressed. Large scutellum exposed. Tegmina short, rounded distad ; wings rudimentary.

Abdomen with distinct stink glands, eighth and ninth tergites widening in strongly increasing ratio. Tenth (ultimate) tergite very ample, smooth, roughly hexagonal ; lateral margins weakly concave in proximal half, thence weakly convex (sometimes sinuous) to the depressed and rectangular laterocaudal angles ; caudal margin with lateral portions weakly oblique convergent and showing weak concavity to median third, that portion transverse and weakly concave, the two projections thus formed very bluntly rounded.

Pygidium directed ventro-cephalad, so that its rounded apex lies between the bases of the forceps. Forceps broad and strongly depressed proximad, forming on the internal margin a heavy and very blunt tooth, the forceps attingent only at this point, thence tapering and arcuate so as to enclose a spade-shaped area which is broader than long. The internal margins of the forceps are otherwise unarmed, the dorsal surface of each arm proximad near the external margin, produced dorsad in a stout conical projection.

Penultimate sternite with lateral margins convergent distad, rounding into the rather broad distal portion, which is weakly concave, showing faint angulation.

Measurements (in millimeters).

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of forceps.	Greatest diameter of forceps
Males—						
Type	9·1	1·43	1·43	1·75	1·56	0·95
Paratype	9·4	1·43	1·45	1·65	1·56	0·92
Paratype	9·7	1·43	1·41	1·72	1·40	0·95

Coloration. Type (recessive). Head blackish brown, shading to prout's brown on occiput. Antennæ yellowish, becoming slightly darker distad. Pronotum warm buff, the prozonal portion buckthorn brown, tinged with blackish brown latero-cephalad. Tegmina blackish brown. Abdomen dorsad tawny, becoming russet proximad and there suffused with blackish brown in lateral portions. Forceps warm buff, becoming tawny in distal portions. Limbs warm buff, the femora this color in proximal two-fifths and distal fifth, remaining two-fifths of femora blackish brown, in striking contrast. The homologous portions of the cephalic and median tibiæ show a clouding on their dorsal surfaces of brown. Ventral surface buffy, except on abdomen where it is ochraceous-tawny. In the generally darker paratypes the prozona and meso-caudal portion of the metazona is prout's brown, shading to mummy brown latero-cephalad on the prozona.

In addition to the type of this handsome species, two paratypic males and an immature individual are before us, which bear the same data.

Diplatys lefroyi Burr.

1910. *Diplatys lefroyi* Burr, Fauna Br. India, Dermaptera, p. 44, Pl. I, figs. 5 and 5*a*. [♂: Belgaum, S. Bombay; Shencottah, Travancore.] [Also recorded from Coimbatore, T. B. F.]

Bassein Fort, Bombay, Bombay Presidency, IX, 1909 (A. Mujtaba), two males.

The limb coloration is not carefully described for this species. In the present specimens the cephalic and median tibiæ and cephalic femora are dark brown, becoming yellowish only at the immediate extremities, the cauda

tibiæ being similar, but becoming paler more extensively distad. The median and caudal femora are yellowish in about the proximal third and in a brief distal portion, the intervening area being strikingly contrasted in blackish brown.

PYGIDICRANINÆ.

Burr's original generic arrangement of the Indian species of this group is clearly faulty[1]. His rearrangement of these species in his genitalic study[2], synonymizing *Pyge* and erecting a new genus *Acrania*, is apparently more satisfactory. As elsewhere in that paper, however, we feel that the external structure should have been much more thoroughly studied and that the characters of the metaparameres and virga should have been added to a general description of the external morphology in separating the genera, particularly in the case of the genus described as new.

Acrania picta (Guérin).

1838. *Pygidicrana picta* Guérin, Mag. de Zool., VIII, Pl. 236, fig. 1, p. 70. [♀; Madras.] Sidapur, Coorg, 31st October 1917 (T. R. Naganathan), one female.

In the present specimen the central oblique tegminal stripe extends unbroken to near the apex of the tegmen.

Length of body 18, length of pronotum 2·9, length of tegmen 5, exposed length of wing 1·7, length of forceps 5 mm.

Cranopygia raja (Burr).

1911. *Kalocrania raja* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 773. [♂; Nilgiri Hills, 6,000 feet.]

Kodaikanal, Madras Presidency, 1920 (C. Leigh), one male, one large juv.

The original description of the Burmese type of *C. valida* (Dohrn)[3] shows that in the type there is quite as much reduction in the organs of flight as in the present specimen. From Burr's comments on *valida*[4] and the present insect, it would appear that very decided individual variation in the development of these parts occurs in both of these species.

The features of difference in coloration, ultimate male tergite and forceps, we believe, fully justify considering *raja* a distinct species.

[1] Fauna Br. India, Dermaptera, p. 53 (1910).
[2] *Jour. R. Microsc. Soc.*, 1915, p. 430 (1915).
[3] *Stettin. Ent. Zeit*, XXVIII, p. 344 (1867).
[4] Fauna Br. India, Dermaptera, p. 56 (1910).

Length of body 27·7, length of pronotum 4, width of pronotum 3·8, length of tegmen 6, length of forceps 7·2 mm.

Cranopygia pluto, new species. (Plate XX, figure 18.)

This large and sombre insect shows, in the male sex, a symmetrical type of forceps which differs widely from that of any other species of the Pygidicraninæ known to us.

Type: male; Chin Hills, Burma, 1909 (Venning). [Hebard Collection, Type No. 775.]

Size large, form robust, the abdomen widening very strongly distad. Antennæ with first segment equal to combined length of second to fifth segments, second segment two-thirds as long as third, third with length one and one-half times its width, fourth slightly broader than long, fifth slightly longer than broad. Head with sutures sub-obsolete, frons and lateral portions of occiput flattened and showing very feeble convexity; caudal margin of occiput straight, transverse; eye slightly longer than cheek.

Pronotum distinctly narrower than head, slightly longer than broad, rectangular, with angles rounded and cephalic margin showing a very weak convexity; prozona and metazona very feebly convex mesad, these portions separated by a broad but shallow, transversely arcuate sulcus. Tegmina short, truncate, without keels at shoulders, leaving a very large scutellum exposed. Wings not visible.

Abdomen pilose, widening distad to the very large ultimate tergite; preceding tergite with latero-caudal angles bluntly rounded, in these areas irregularly rugose. Ultimate tergite broader than long, shining, rugulose and becoming rugose laterad and distad, raised in a low blunt projection above the internal portion of each arm of the forceps, moderately concave between these, with a very narrowly transverse, smooth area and laterad of these prominences more strongly concave. Pygidium concealed, directed cephalad.

Forceps heavy, symmetrical, almost evenly convex, but showing slightly the greatest curvature mesad; dorsal surface impressed and longitudinally striate proximad, weakly convex distad, as is the entire ventral surface, which is well supplied with hairs. Forceps proximad very heavy, the internal portion of the arms produced so as to meet, forming a nearly vertical, interlocking series of a few heavy, blunt teeth, beyond this point the internal surface is concave as the arm narrows to the median point, the dorso-internal margin bluntly produced at its base, the ventro-internal margin armed with a series of minute but distinct tubercles to the median point. The distal half of the forceps is stout and expands very weakly at the apex, which is bidentate;

the external (distal) portion blunt conical, the internal margin produced in a smaller blunt knob, with a few very small knobs along its distal face toward the distal projection. Penultimate sternite large, with lateral margins oblique to the broad apex, which is weakly concave mesad and convex laterad.

Limbs strongly compressed and carinulate. Caudal metatarsus slightly longer than combined length of the two succeeding joints ; hirsute, this very heavy ventrad.

Length of body 25·5, greatest width of head (across eyes) 3·74, length of pronotum 3·53, greatest width of pronotum 3·33, length of tegmen 4·7, greatest width of ultimate tergite 6·7, length of forceps 6·8 mm.

Head blackish chestnut brown, paling to cinnamon brown between the eyes. Antennæ tawny. Pronotum and tegmina dull, deep chestnut brown. Abdomen more polished, deep chestnut brown, darkening to blackish distad. Forceps blackish chestnut brown. Limbs immaculate, ochraceous tawny.

The type is unique.

Cranopygia kallipyga (Dohrn).

1863. [*Pygidicrana*] *kallipygos* Dohrn, Stettiner Ent. Zeit., XXIV. p. 53. [♂, ♀ ; Eastern India.]

Snowdon Peak, Nilgiri Hills, Madras Presidency, 8,000 feet, 6th September 1917 (Y. R. Rao ; on the bark of a tree), one male, one female.

In the male, the forceps have a stout tooth proximad at the external margin, directed dorsad. This is as originally described, not "somewhat crested irregularly," as given by Burr.

Length of body, male 20·5, female 19 ; length of pronotum male 3, female 3·3 ; width of pronotum male 2·8, female 3·1 ; total length of tegmen* male 3·6, female 3·6 ; length of forceps male 5, female 5·4 mm.

LABIDURIDÆ.

Psalinæ.

We agree with Burr's statements in 1915[1] that the genera *Psalis*, *Anisolabis* and *Euborellia*, as previously defined by him, constituted an unnatural grouping which necessitated complete rearrangement. We deplore his method in that paper, however, of erecting new genera based solely on the characters of the male metaparameres. We feel that, carefully studied,

* Concealed, except from the side, for 0·5 mm.

[1] *Jour. R. Microsc. Soc.*, 1915, *p.* 544.

such units, if valid, will show adequate diagnostic features of difference in the external structure. Until treated in such manner, however, it is a difficult matter to decide whether the genera so erected deserve recognition and still more difficult to place generically such species as Burr omitted from his evidently hurried genitalic study.

Homœolabis maindroni Borelli.

1911. *Homœolabis maindroni* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino ; XXVI, No. 640, p. 2. [♂, Pondicherry.] [Also recorded from Coimbatore, Bangalore and Coorg. T. B. F.]

Sidapur, Coorg, 13th to 14th May 1914 (T. Bainbrigge Fletcher), one female.

Coimbatore, Madras Presidency, 1921 (A. P. Nathan), one male, one female.

This species has been discussed by Burr[1]: we offer the following data :—

Stink glands obsolete. Abdominal surface very minutely impresso-punctulate dorso-proximad, more strongly so ventrad, almost smooth dorso-distad, well supplied with hairs distad and less decidedly so laterad ; distal tergites scarcely at all produced laterad. Pygidium vertical, very narrow. Forceps very similar in the sexes, very slightly heavier in male than in female ; heavy, with branches straight to the immediate apices, which are incurved ; ventral surface weakly and dorsal surface more strongly convex, the latter with a proximal scarification on external half, formed by a transverse series of short, irregular, longitudinal ridges and there well supplied with short hairs ; ventro-internal margin supplied with very low, blunt, nodiform teeth, which decrease in size and become more regular distad. Penultimate sternite with free margin broadly and evenly convex.

The armament of the caudal metatarsus in this species apparently agrees closely with that of *Titanolabis**. Ventral surface armed on external margin with a row of heavy, widely spaced spines, the entire ventral surface thickly supplied with elongate, stiff bristles, which on the ventral portion of the internal face become much more numerous and shorter, there appearing furry.

Length of body, male 17·3, female 16 and 19·5 ; length of pronotum† male 2·24, female 2·31 and 3·13 ; greatest (caudal) width of pronotum

[1] *Proc. Asiatic Soc. Bengal (N. S.)*, VII, p. 777 (1911).

* Comparison is made with imperfect specimens of *T. colossea* (Dohrn), from New South Wales, Australia, in the Philadelphia Collections.

† Not including the greatly depressed neck which measures—Male, 0·24, female, 0·34 and 0·34 mm.

male 2·33, female 2·18* and 2·35; length of tegmen male 1·77, female 1·84 and 2·04; width of tegmen male 0·42, female 0·61 and 0·47; length of forceps male 3, female 3·26 and 3·4; proximal width of forceps male 1·36, female 1·37 and 1·38 mm.

Paralabis greeni (Burr). (Plate XIX, figure 3.)

1899. *Anisolabis greeni* Burr, Ann. Mag. Nat. Hist. (7), IV, p. 257. [♂, ♀; Pundalu-oya (nec Punduloya), Ceylon.]

Pundalu-oya, Ceylon, (E. E. Green), one male, "*type*" (which we here designate as single type), [British Museum].

Hopeville Estate, Shevaroy Hills, Madras Presidency, 16th October 1912 (T. B. Fletcher), one male, [British Museum].

Through the kindness of the authorities of the British Museum, we are able not only to diagnose Burr's *greeni* more fully, but also to verify the presence in Southern India of this species.

In *greeni* the head, pronotum, mesonotum, metanotum and dorsal surface of the abdomen are all very finely but decidedly and thickly impresso-punctulate, the tegmina slightly less so. This is not true for *P. castetsi* (Bormans) and *Epilabis penicillata* (Borelli). The former has the head and pronotum polished and punctulations sub-obsolete, the remaining dorsal portions with a finer punctulation; the latter has the head and pronotum polished and smooth and remaining portions even more finely punctulate.

Though in general structure agreeing more closely with *penicillata*, *greeni* does not show as decided narrowing of the abdomen caudad and the ultimate tergite is, therefore, wider. The male sex of that species is quickly distinguished by the remarkable specialization of the penultimate sternite.

The male forceps of *greeni* are weakly asymmetrical, with a sub-obsolete tooth meso-proximad, rather than mesad, as described by Burr. In the type the limbs, mouthparts and all but distal portion of the last of the first three antennal joints are tawny, the femora slightly darker distad. The Shevaroy specimen differs in having these portions less contrastingly paler than the other dark brown parts of the insect, the proximal antennal joints scarcely paler than the others. Both have the thirteenth antennal joint buffy or ochraceous.

The vestigial tegmina in this species and the apparently very closely related *P. astruci* (Burr) are of the same remarkable type developed in *castetsi* and *E. penicillata*.

* The pronotum is deformed in this specimen.

The generic position of the species is in doubt. The species certainly appears to be congeneric with *penicillata* and Burr stated the possibility of this being the case when referring *greeni* to his new genus *Paralabis*[1].

The measurements of the two males before us are as follows, those of the type being given first: length of body 14 and 14·2, length of pronotum (exclusive of neck) 2·14 and 2·35, width of pronotum 2·31 and 2·52, length of tegmen 0·88 and 1·04, width of tegmen 1·22 and 1·43, length of forceps 2·9 and 3·1 mm.

Paralabis castetsi (Bormans). (Plate XIX, figure 4.)

1897. *C[arcinophora] castetsi* Bormans in Bolivar, Ann. Soc. Ent., France, LXVI, p. 284. [♂, ♀; Kodaikanal, Madras Presidency, India.]

Kodaikanal, Madras Presidency, 26th March to 2nd April 1921 (C. Leigh), thirteen males, fourteen females, three juv.

This is a smaller, proportionately broader, darker and more polished insect than *P. greeni* (Burr). The development of the male forceps, moreover, is distinctive, the curvature different in the more specialized condition and the internal margin never toothed.

The species, like *greeni*, is subject to decided size variation. The maximum for the former is not as great, however, as the minimum known for the latter. Burr failed entirely to recognize its correct relationship, assigning it to the genus *Psalis* without comment.

The following changes are noted in depauperate individuals of the species. The arms of the male forceps from asymmetrical and wellbowed to similar and scarcely arcuate. The sides of the male abdomen with latero-caudal portions of the tergites from angulate, produced and carinulate to scarcely produced (and that only for the distal tergites), rounded and not carinulate.

In the present series the length measurements are: male 7 to 10·3, female 8 to 10·2 mm. The smallest males have the forceps so weakly curved that, in this respect, they are not distinguishable from some of the females.

In coloration the specimens have the head, pronotum and abdomen very dark, the antennæ and limbs paler. The antennæ have the first two joints, and sometimes one or two joints distad, paler than the others.

Epilabis penicillata (Borelli). (Plate XIX, figures 5 and 6.)

1911. *Euborellia penicillata* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XXVI, No. 640, p. 3. [♂, ♀; Coonoor (India).]

[1] *Jour. R. Microsc. Soc.*, 1915, p. 540 (1915).

Ootacamund, Nilgiri Hills, Madras Presidency, May 1912 (K. S. Padmanabha), one male, one female.

The remarkable specialization of the male penultimate sternite, described by Borelli, is here figured. These specimens are paler and more reddish than the specimens of *Paralabis greeni* (Burr) before us, particularly cephalad. The antennæ and limbs are paler than the other portions much as in the specimen of *greeni* from the Shevaroy Hills, the former, however, showing no trace of annulation distad.*

Length of body, male 13·8, female 11·7, length of pronotum (exclusive of neck), male 2·04, female 1·94, width of pronotum, male 2·18, female 2·08, length of tegmen, male 0·85, female 0·85, width of tegmen, male 1·22, female 1·22, length of forceps, male 2·38, female 2·5 mm.

Euborellia annandalei (Burr).

1906. [*Anisolabis*] *annandalei* Burr, Jour. Asiatic Soc. Bengal (N. S.), II, p. 389. [♂; Comilla, Purneah District (Bengal).]

In Burr's latest revisionary work[1] this species is not assigned. The correct generic position consequently remains in doubt.

Comilla, Purneah District, Bengal, 20th February 1906 (C. S. Misra), two females.

This topotype is the first female of *annandalei* to be reported. The sex agrees closely with the description of the male, except in the following features: abdomen slightly widest mesad, distal tergites with latero-caudal angles bluntly produced at slightly over ninety degrees and with surfaces there impresso-punctulate. Ultimate tergite showing a very weak, mediolongitudinal, linear sulcus; surface weakly wrinkled distad; with a weak, blunt keel laterad, there impresso-punctulate. Penultimate sternite rectangulate produced caudad, with apex very broadly rounded. Forceps with branches straight to the incurved apices, weakly and bluntly triquetrous proximad, almost attingent, with ventro-internal margin showing a series of very small, blunt, nodiform teeth. The caudal metatarsus is armed with two ventral rows of small spines, flanked internally by a fringe of lamellate plates and well supplied with hairs. This same type is found in *Paralabis castetsi* (Bormans) and *Epilabis penicillata* (Borelli).

Length of body 13·2, length of pronotum 2·38, greatest (caudal) width of pronotum 2·28, length of tegmen 1·97, width of tegmen ·77, length of forceps 3·4 mm.

* See further comparison under that species.

[1] *Jour. R. Microsc. Soc.*, 1915-1916.

Euborellia stâli (Dohrn).

1864. *F[orcinella] stâli* Dohrn, Stettin Ent. Zeit., XXV, p. 286. [♀, Java.]

1907. *Anisolabis minuta* Caudell, Jour. New York Ent. Soc., XV, p. 168. [♂, ♀; Arroyo and Mayaguez, Porto Rico.]

Coimbatore, Madras Presidency, 1921 (A. P. Nathan), one male, one female.

Compared with a West Indian series, recorded by Rehn and Hebard as *Euborellia minuta* (Caudell), in 1917, demonstrates the synonymy indicated above. The size differences, which we noted at that time and which we believed indicated the probability of *minuta* being a distinct species, are worthless. Burr had already suggested the above synonymy,[1] but apparently without comparison of West Indian specimens with material from the Far East.

The West Indian material before us averages more recessive in coloration than the pair here recorded (which apparently show the normal coloration for Indian material), but, as would be expected, a number of specimens from the West Indies are fully as dark as these.

Length of body, male 8·2, female 9·7; length of pronotum, male 1·2, female 1·36; caudal width of pronotum, male 1·2, female 1·43; length of tegmen, male 0·95, female 1·09; width of tegmen, male 0·35, female 0·47 and 0·54; length of forceps, male 1·29, female 1·97 mm.

Euborellia annulipes (H. Lucas).

1847. *Forficesila annulipes* Lucas, Ann. Soc. Ent. France, (2), V, p. LXXXIV. ["Jardin des Plantes, Paris"; probably introduced.]

Abbottabad, Hazara District, North-West Frontier Province, 21st May 1915 (T. Bainbrigge Fletcher), one female.

Hangu, North-West Frontier Province, 10th May 1916 (T. Bainbrigge Fletcher), two males.

Sargodha, Chenab Colony, Punjab, August 1906 (H. M. Lefroy), one male.

Pusa, Bihar, 11th June to 21st September 1908 and 1920, two males, seven females, one juv. female.

Laitlyngkot, Khasia Hills, Assam, 5,500 feet, 16th October 1920 (T. Bainbrigge Fletcher), one male, one female.

Upper Shillong, Khasia Hills, Assam, 5,800 to 6,000 feet, 12th to 15th June 1918 (T. Bainbrigge Fletcher), one male.

Santikoppa, North Coorg, 4th to 10th May 1914 (T. Bainbrigge Fletcher; on fruit of *Careya arborea*), one female.

[1] Gen. Ins., Dermaptera, Fasc. 122, p. 31 (1911).

Coimbatore, Madras Presidency, 7th January 1921 (A. P. Nathan), one male, one female; 24th July 1912 (T. V. Ramakrishna Ayyar), one female.

The present series exhibits the usual colour variation shown by *annulipes*, the limbs being conspicuously annulate in the majority of specimens. In the examples from Laitlyngkot, however, the annuli are very broad, heavy and sharply defined, while in those from Hangu they are obsolete.

The latter specimens are exceptionally large and heavy for the species, the male showing the maximum curvature of the forceps developed, which closely resembles the normal type of these appendages developed in *E. mœsta* (Géné).*

The specimen from Santikoppa is very remarkable in possessing truncate tegmina, which overlap and reach slightly beyond the caudal margin of the mesonotum. A very few specimens of this species are known with fully developed tegmina and wings, but this is the first specimen to be recorded showing the present condition. The presence and character of the tegmina would lead one first to suppose this specimen to be near "*Psalis*" *lefroyi* (Burr) but we believe instead that it is simply an individual of *annulipes* abnormal in this respect.

Labidurinæ.

Labidura riparia (Pallas).

1773. *Forficula riparia* Pallas, Reise, Russ. Reichs, pt. II, p. 727. [Shores of Irtysch River, Western Siberia.]

The series of seventy-three Indian specimens, now before us, shows the same variability which was thoroughly discussed by Burr, in 1910.[1] At that time *bengalensis* was recognized as distinct species, but after careful consideration of the evidence at hand we feel convinced that it represents nothing more than the most striking variant developed in *riparia* in the Indian region. Burr reached the conclusion that *bengalensis* did not merit specific recognition in 1915.[2]

In spite of even greater variation than occurs in the species in the New World, the Indian examples show one average difference, varying in degree but exhibited by all the material before us from that region. This lies in the average slightly stronger denticulation of the ventro-internal margin of the

* Very close agreement in these features is shown by the optimum males before us from Miami, Florida.

[1] Fauna Br. India, Dermaptera, p. 100.

[2] *Jour. R. Microsc. Soc.*, 1915, p. 444.

forceps in the female sex. The largest specimens of the *bengalensis* variant show this feature strikingly. In the depauperate condition, which it would appear best to refer to as the *inermis* variant, however, this denticulation is likewise distinctly stronger than in any series before us from localities not in the Indian region.

In treating variants such as here occur, we believe that a system of symbols, much like that used by Rehn and Hebard for the American species of the genus *Gryllus*, constitutes the most satisfactory method by which the individuals recorded may be characterized. For the present species we would suggest the following :—

Coloration.

A—very light.
B—medium.
C—dark but showing contrasts.
D—dark and showing no contrasts.
E—brilliant.
F—moderately bright.
G—dull.

Organs of Flight.

W—very short, extreme tips of wings alone projecting.
X—short, tips of wings projecting.
Y—slightly reduced.
Z—fully developed.

Male Genitalia.

a—caudal margin of ultimate tergite unarmed.
b—caudal margin of ultimate tergite armed with two sub-obsolete points
c—caudal margin of ultimate tergite armed with two acute points.
d—internal margin of forceps with teeth sub-obsolete.
e—internal margin of forceps with a meso-distal tooth.
f—internal margin of forceps with a meso-proximal and a meso-distal tooth.
g—internal margin of forceps with a meso-proximal and a meso-distal tooth, and other smaller teeth.
h—internal margin of forceps with a meso-proximal and a meso-distal tooth, and other smaller teeth, the majority of which are beyond the meso-distal tooth.
w—serrulation of ventro-internal margin of female forceps obsolete.
x—serrulation of ventro-internal margin of female forceps very weak.
y—serrulation of ventro-internal margin of female forceps distinct.
z—serrulation of ventro-internal margin of female forceps well developed,

Size.

1—very large.
2—large.
3 medium.
4—small.
5—very small.

The variants included in the present series we would characterize as follows:—

riparia (Pallas) A to C, F to G, X to Z, a to c, d to f, w to y, 1 to 4.

Typical condition—BF $\left\{\begin{matrix}\text{Zc}\\\text{Xa}\end{matrix}\right\}$ ex $\left\{\begin{matrix}2\\3\end{matrix}\right\}$

bengalensis Dohrn[1] B to C, EZahz2.

icterica (Serville)[2] A to B, FXa, weak f to g, y, 3 to 4.

inermis (Brunner)[3] DGWa, d or very weak f to g, x to y, 5.

It is probable that Brunner's variety is based on merely the very depauperate condition of *riparia*, which is not as dark and does not have the tegmina as strongly truncate as does the Indian variant here characterized. If this is true, no name is available for the Indian condition, but we are opposed to naming any such variants and believe it best to record the present material as variant *inermis*, with this necessary qualification.

Gandarbal, Kashmir, 5,600 feet, September 1917 (Dutt), one male[4], BEZce2.

Keonthal, Simla Hills, 8,000 feet, December 1908 (G. M. Carson), eleven males, twelve females,[5] eight juv., DGWa, d to very weak g, y5.

Pusa, Bihar, 15th March to 1st November 1909 to 1914, six males, eight females, five juv., one pair CEYahz2, others[6] A to B, F, X to Z, a, weak f to g, weak z to z, 3 and 4.

Chapra, Bihar (Mackenzie), one male,[7] BEZah2, one female, BEZce2.

Comilla, Bengal Presidency, 19th January 1906 (A. Wahab), two juv.

[1] Described from Bengal as *Labidura bengalensis*, *Stettin Ent. Zeit.*, XXIV, p. 312 (1863).

[2] Described from Pondicherry as *Forficelisa icterica*, *Hist. Nat. Ins., Orth.*, p. 24 (1839).

[3] Described from Bruck, Lower Austria, and Serbia as *Labidura riparia* var. *inermis*, Prodr. Europ. Orth., p. 5 (18).

[4] Typical *riparia*, except in being more brilliantly coloured.

[5] This series is typical of the depauperate dark form, which is best called the *inermis* variant.

[6] Typical *icterica* variant.

[7] Typical *bengalensis* variant.

Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, July 1919 (T. Bainbrigge Fletcher), five males, five females[1], CEZ, one b, others c. f, weak z, 2.

Dacca, Eastern Bengal, 23rd July 1917 (in parasitic growth on mango), one male, CEZbf2.

Nongpoh, Khasi Hills, Assam, July 1907 (D. Nowroji), one male, CZa, weak g, slender 2.[2]

Poona, Bombay Presidency, December 1908 (R. D. Deshmukh; under stones), two juv.

Jubbulpur, Central Provinces, 9th January 1918 (A. G. Ramaswami), one female, BFXz3.

Coimbatore, Madras Presidency, 12th October 1912 (A. G. Ramaswami), one female, CGXz3.

The Keonthal series is of particular interest in showing the maximum degree of depauperation for the species. The extremes in this series are: length of body, male 8·7 to 13, female 9·7 to 12·1; length of forceps, male 3·2 to 4·3, female 3·7 to 4 mm. The smallest males might easily be mistaken for females, so greatly simplified are the forceps, while the ultimate abdominal tergite is narrowed and tapers distad.

The enormous size variation in the species is shown by the fact that the extremes of length, exclusive of forceps, for the series here recorded, are 8·7 to 22·5 mm.

Nala lividipes (Dufour). (Plate XIX, figures 7, 8 and 9.)

1820. *Forficula pallipes* Dufour, Ann. gén. Sc. phys. Bruxelles, V, p. 316, Pl. CXVI, figs. 7, 7*a* and 7*b*. [♂, ♀; Lower Catalonia, Spain.]

1828. *F* [*orficula*] *lividipes* (Dufour), new name proposed Ann. Sc. Nat., XIII, p. 340.

Haripur, Hazara District, North-West Frontier Province, 27th May 1915 (T. Bainbrigge Fletcher), one male.

Taru, Peshawar District, North-West Frontier Province, 16th to 29th May 1915 (T. Bainbrigge Fletcher), one male, one female.

Hoshangabad, Central Provinces, 14th to 19th September 1911 (T. Bainbrigge Fletcher), two females.

Janjgir, Bilaspur, Central Provinces, October 1915 (C. S. Misra), one male.

[1] One of these males has one of the arms of the forceps unspecialized, simple, cylindrical and 7 millimeters in length; the length of the other normal arm being 9·7 millimeters.

[2] This condition agrees closely with the type of the synonymous *Apterygida huseinæ* Rehn, from North-Eastern Africa.

Pusa, Bihar, 31st March to 2nd November 1904 to 1919 (18 taken at light[1]), ten males, sixteen females.

Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, July 1919 (T. Bainbrigge Fletcher), one male.

Barisal, Bengal, 29th May 1906 (H. M. Lefroy), one female.

Coimbatore, Madras Presidency (C. S. Misra), one female.

Lebong, near Darjiling, Sikkim, 5,000 feet, September 1908 (H. M. Lefroy), one female.

In a very few specimens the immediate basal portion and the tip of the exposed portion of the wings are slightly paler than elsewhere. In a larger number of specimens only the tips of these organs are slightly paler, but the great majority of individuals have tegmina and wings solidly unicolorous.

Accompanying size variation, we find the male forceps varying from an armed type (Plate XIX, figure 7), through an unarmed type (Plate XIX, figure 8), to a simple type (Plate XIX, figure 9), in which both teeth and characteristic curvature have disappeared. In the series before us the following males have armed forceps: Pusa 4, Goalundo to Gauhati 1, Taru 1, Janjgir 1. The specimen from Haripur has the form as normal for *lividipes*, but lacks the meso-distal teeth, while the other males are smaller and have evenly and weakly curved, unarmed forceps.

Nala nepalensis (Burr).

1907. [*Labidura*] *nepalensis* Burr, Rec. Indian Mus., I, p. 208. [♂, ♀; Soondrijal and Pharping, Nepal.]

Abbottabad, Hazara District, North-Western Frontier Province, June 1916 (T. Bainbrigge Fletcher), one male.

In this specimen the annulation of the limbs is reduced to a very weak suffusion, while the organs of flight show some reduction (length of tegmen 1·77, length of exposed portion of wing 0·27 mm.). Otherwise it agrees fully with the original description.

Forcipula decolyi Bormans.

1900. *Forcipula decolyi* Bormans, Ann. Mus. Civ. Stor. Nat. Genova (2), XX, p. 444. [♂, ♀; Haveri, British New Guinea.]

Palni Hills, Madras Presidency, 5,000 feet (C. Leigh), two females, two juv.

The adult females measure: length of body 22-26, length of tegmen 4·8-5, length of forceps 8-7·8 mm.

[1] See note by Annandale on appearance of this species at light, in Burr, Fauna Br. India, Dermaptera, p. 15 (1910).

Forcipula despinosa Hebard.

1917. *Forcipula despinosa* Hebard, Proc. Acad. Nat. Sc. Philadelphia, 1917, p. 234, Pl. XVI, fig. 1. [♂, Northern India.]

The microscopically pitted metazona, tegmina and wings are apparently the most distinctive features in this species.

We believe that the size and number of projections on the abdominal tergites are probably subject to considerable individual variation in the majority, if not all, of the species of *Forcipula*.

Forcipula lurida Bolivar.

1897. *F*[*orcipula*] *quadrispinosa* var. *lurida* Bolivar, Ann. Soc. Ent. France, LXVI, p. 283 [♂, Madras Presidency.]

Pusa, Bihar, 15th May 1917 (T. Bainbrigge Fletcher), one female.

Damukdia, Sara, Bengal, 26th March 1911 (T. Bainbrigge Fletcher; at light on steamer), one female.

Gauhati, Eastern Bengal, 25th April to 4th May 1918 (T. Bainbrigge Fletcher), two males.

The two males before us differ from the material previously recorded in having only the third and fourth tergites showing a lateral oblique keel, these keels produced in a tooth, the caudal margin of which bears very minute teeth. The reduction in number of such keels we believe to be wholly attributable to individual variation. In the male showing the greater reduction of these keels, the forceps lack all denticulation excepting the heavy median tooth.

PARISOLABIINÆ.

Pseudisolabis elegans Hebard.

1917. *Pseudisolabis elegans* Hebard, Proc. Acad. Nat. Sc. Philadelphia, 1917, p. 236, Pl. XVI, figs. 2 and 3. [♂, ♀; Kulu, Kangra, India.]

This species agrees with *P. tenera* Burr[1] in coloration, and with *P. immsi* Burr[2] in form of the male forceps. It is possible that all may eventually prove to be variants of one species. If two valid species alone survived, however, it is probable that these would be *P. burri* Borelli and *P. immsi* Burr.

[1] Described in Fauna Br. India, Dermaptera, p. 104, Pl. IV, fig. 36 (1910). [♂, Murree, Punjab.]

[2] Described in *Jour. Asiatic Soc. Bengal* (*N. S.*), IX, p. 184, fig., (1913). [♂, ♀; Kuridi, Jaunsar, Base of Himalayas, Northern India.]

BRACHYLABIINÆ.

Metisolabis bifoveolata (Bolivar).

1897. [*Brachylabis*] *bifoveolata* Bolivar, Ann. Soc. Ent. France, LXVI, p. 285, Pl. 10, fig. 1. [♂, Madras Presidency.]

Kodaikanal, Madras Presidency, 26th March 1921 (C. Leigh), one female.

We can not agree with Burr's assignment, in 1911,[1] of this species to the genus *Ctenisolabis*. In the present specimen the antennæ have 14 segments, the third nearly twice as long as broad, the fourth rounded quadrate, the succeeding segments longer than broad, becoming more elongate and slender distad.

The first three antennal segments are dark reddish brown like the limbs, the other segments blackish like the dull head, pronotum, abdomen and forceps.

As figured by Bolivar, the eyes are only slightly longer than the cheeks. The antennæ are so jointed that they swing back readily, at a decided angle, to the apex of the first segment. This gives to individuals a distinctive facies which appears to constitute a peculiarity of the species of this subfamily.

The female before us differs from the described male in lacking stink glands, though there is a scarred emargination of the caudal margin of the third tergite on each side in place of these.

Length of body 11·8, length of pronotum 2·56, least (cephalic) width of pronotum 1·84, greatest (caudal) width of pronotum 2·79, greatest (mesocaudal) width of abdomen 4·08, length of forceps 2·18 mm.

Nannisolabis formicoides Burr.

1911. *Nannisolabis formicoides* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 781. [♂, ♀; Shembaganur, Madura District, Southern India.]

Kodaikanal, Madras Presidency, 26th and 30th March 1921 (C. Leigh). two males, one female.

We cannot help feeling a certain amount of hesitancy in thus recording the present material. Though we have no direct evidence, there would seem to be a possibility that these specimens represent immature individuals of *Metisolabis bifoveolata* (Bolivar) and that *Nannisolabis* is a genus having no validity, including "species" based on the immature condition of that and other species of the *Brachylabiinæ*.

In the material before us, the eyes and antennæ are as in the female of *M. bifoveolata* here recorded, except that the tenth, eleventh and twelfth

[1] *Jour. Asiatic Soc. Bengal (N. S.)*, VII. p. 780.

antennal segments are buffy. The head, pronotum, abdomen and forceps are black and shining, the limbs buffy, but with femora suffused with blackish to near their extremities.

There is a scarred emargination on each side of the caudal margin of the third abdominal tergite in both sexes.

Length of body male 6·3 to 6·8, female 5·9; length of pronotum male 1·08 to 1·15, female 1·15; cephalic width of pronotum male 0·85 to 0·88, female 0·85; caudal width of pronotum, male 1·18 to 1·22, female 1·3; greatest (meso-caudal) width of abdomen, male 1·48 to 1·5, female 1·7; length of forceps. male 0·85 to 0·88, female 1·08 mm.

LABIIDÆ.

Labiinæ.

Spongovostox semiflavus (Bormans).

1895. *Sp*[*ongophora*] *semi-flava* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XXXIV, p. 385. [♂, ♀; Carin-Chebá and Carin Ghecù, Burma.]

Savira Butti, South Coorg, 22nd May 1914 (T. Bainbrigge Fletcher; under bark), one female.

This unique female agrees so closely with the original description of *semi-flavus* that we feel justified in so recording it.

A large, blunt, internal projection on the arms of the forceps causes these to be attingent proximad, from which point they are slender, straight, with internal face showing minute denticulations, to the incurved apices.

Length of body[1] 6, length of pronotum 1·05, cephalic width of pronotum 0·95, caudal width of pronotum 1·22, length of tegmen 1·97, length of exposed portion of wing 0·54, length of forceps 1·9 mm.

Chætospania Karsch.

One problem concerning the use of this generic name confronts the systematist. That is the proper generic position of *major*, the genotype of *Platylabia*, described from a single female, from the Island of Celebes. Four species were originally described under *Platylabia*, the first of which has been selected as genotype.[2] The second, *thoracica*, is a species congeneric with *Chætospania*, while the third and fourth have been placed in synonymy under *Labia curvicauda* (Motschulsky).

[1] The specimen before us has shrunk considerably in drying.

[2] By Kirby, Syn, Cat, Orth, I, p. 21 (1904).

We hold that the true generic relationship of *major* cannot at the present time be determined, and that, as it is highly probable that *major* is not congeneric with *thoracica*, the generic name *Platylabia* must be held for the single species *major*. Should *major* and *thoracica* be found to be congeneric, *Chætospania* would fall as a synonym of the older *Platylabia*. On the other hand, should the Malayan and Burmese species *sparattoides* prove to be a synonym of *major* (as has been assumed, but not satisfactorily proven, by Burr), or congeneric with that species, the genus *Palex*, which Burr erected for *sparattoides* and then placed under *Platylabia*, would indeed fall as a synonym of *Platylabia*. This latter conclusion we cannot concur in, on the same grounds that we retain *Chætospania*.

Hence we recognize, for the present, the genera : *Platylabia*, with genotype *major*, from the Island of Celebes ; *Chætospania*, with genotype *inornata*, from Madagascar ; and *Palex*, with genotype *sparattoides*, described from the Islands of Penang and Sumatra.

The most important references bearing on this complicated problem may be summarized as follows :—

1867. *Platylabia* Dohrn, Stettin Ent. Zeit., XXVIII, p. 347.

1886. *Chætospania* Karsch, Berliner Ent. Zeitschr., XXX, p. 87.

1895. *Platylabia major* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XXXIV, p. 380.

1900. *Platylabia sparattoides* Bormans, Ann. Mus. Civ. Stor. Nat. Genova, XL, p. 459.

1910. *Palex* Burr, Fauna Br. India, Dermaptera, p. 68 and Trans. Ent. Soc. London, 1910, p. 162.

1911. Burr, Stettin Ent. Zeit., 1911, p. 338 ; Jour. Asiatic Soc. Bengal (N. S.), VII, p. 774 and 775, and Deutsch. Ent. Nat.-Biblioth, II, 1911, p. 60.

1912. Burr, Annal. k. k. Nat.-hist. Hofmus. Wien, XXVI, p. 82.

Chætospania kurseongæ, new species. (Plate XIX, figures 10 and 11.)

This handsome little insect is distinguished from the other known species of the genus by the striking contrast of coloration and form of the pygidium in the sexes.

Type : male ; Kurseong, Northern Bengal, India. Altitude 4,500 feet. June 1920. (From C. Leigh.) [Hebard Collection, Type No. 770.]

Size small, form moderately slender and depressed. Head flattened, sutures sub-obsolete, caudal margin of vertex broadly and roundly obtuse-angulate emarginate. Eye slightly over half as long as cheek. Antennæ with first joint twice as long as third, fourth as long as third, succeeding joints

nc reasing gradually in length distad, grading from very elongate pyriform to elongate ovate. Pronotum distinctly narrower than head; prozona very feebly convex, remaining portions deplanate; lateral margins straight and parallel, caudal margin broadly convex. Tegmina and wings fully developed. Abdomen lacking stink glands, widest meso-distad, ultimate tergite thickened above forceps and impressed in intervening area.

Pygidium convex declivent and as broad as arm of forceps to distal portion, which is horizontally produced in a flange, with short lateral margins diverging slightly, so that this flange completely fills the space between the forceps, its caudal margin transverse. Forceps nearly straight to incurved apices, flattened dorsad and ventrad and showing a faint longitudinal linear sulcation along the external margins; internal surface concave proximad, with ventro-internal margin there sub-serrulate, armed with a heavy tooth, directed mesad at end of proximal three-fifths, this tooth formed by a gradual widening of the ventro-internal margin from half the distance to the base of the forceps. Penultimate sternite broadly convex, almost truncate distad.

Limbs short, femora stout. Caudal metatarsus as long as last tarsal joint, armed ventrad with two rows of spines and well supplied with hairs on ventral portion of internal surface. Second tarsal joint short and simple. Entire insect pilose.

Allotype: female; same data as type. [Hebard Collection.]

Agrees with male except as follows: ultimate tergite with thickening at bases of forceps slightly heavier and intervening area less depressed. Pygidium more weakly declivent, proximal portion weakly convex, directed disto-ventrad, so that the pygidium projects further, distal portion horizontal; lateral margins straight, parallel and weakly serrulate, distal margin very weakly obtuse-angulate emarginate, thus large and weakly acute-angulate, deplanate disto-lateral angles are formed.

Forceps slightly heavier than those of male; ventro-internal margin weakly serrate proximad, expanding gradually into a flange beyond pygidium to median point, thence as this flange gradually narrows its margin undulates, disappearing at base of incurved distal extremity of forceps. Penultimate sternite with free margin broadly convex, but more strongly convex than in male.

Length of body, male 7·5, female 7·7; length of pronotum, male 1·08, female 1·05; width of pronotum, male 0·92, female 0·95; length of tegmen, male 1·84, female 1·97; length of exposed portion of wing, male 0·98, female 1·02; greatest width across tegmina, male 1·5, female 1·54; length of forceps, male 2·58, female 2·45 mm.

Coloration of sexes. Head, tegmina and wings blackish brown, covered with coppery pile. Antennæ prout's brown, the last three (tenth to twelfth) segments warm buff. Pronotum, prosternum and limbs ochraceous-buff tinged with tawny, remaining underparts tawny, except the mesosternum which is suffused with blackish. Abdomen russet, becoming slightly deeper distad and there matching the pygidium and forceps.

The typical pair alone represent the species.

Chætospania stiletta Burr. (Plate XIX, figures 12 and 13.)

1911. *Chætospania stiletta* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 786. [♂, ♀; Shembaganur, Madura District.]

Kodaikanal, Madras Presidency, 1920 (C. Leigh), three males, two females, three juv.

The cephalic femora, which are strikingly darker than any other portion of the limbs, lanceolate male pygidium, more highly specialized forceps and comparatively large size are features which readily distinguish this species from any of the other known forms of the genus.

The species bears a striking, though purely superficial, resemblance to certain species of the American genus *Prosparatta*, agreeing closely in size and form with the Mexican *P. flavipennula* (Rehn), though appreciably more deplanate.

As the pygidium and forceps have not been previously figured, we have given illustrations of these appendages for both sexes of this interesting species.

Length of body, male 9·7, female 9·1; length of pronotum, male 1·38, female 1·3; width of pronotum, male 1·15, female 1·06; length of tegmen, male 2·24, female 2·25; length of exposed portion of wing, male 1·15, female 1·22; greatest width across tegmina, male 1·8, female 1·84; length of forceps, male 3·33, female 3·2 mm.

Labia pilicornis (Motschulsky).

1863. *Forfiscelia pilicornis* Motschulsky, Bull. Soc. Imp. Nat. Moscou, XXXVI, Part 2, p. 2. [♀; Nuwara Eliya Mountains, Ceylon.]

Pusa, Bihar, 17th November 1916 (H. Singh), one female.

This specimen, like material which we have recorded from the Hawaiian Islands, is blackish mummy brown, paling gradually to tawny on the forceps. As a result it is an appreciably darker insect than *L. minor* (Linnæus), though, as Burr has stated, there is some superficial resemblance between these species. Both are so small that the striking structural differences which they exhibit can scarcely be noted by the naked eye.

Prolabia arachidis (Yersin).

1860. *Forficula arachidis* Yersin, Ann. Soc. Ent. France (3), VIII, p. 509, Pl. X, figs. 33 to 35. [Adventive at Marseilles, France.]

Pusa, Bihar, 20th October 1908 (R. D. Deshmukh; at light), one female; 7th November 1906 (H. M. Lefroy), one male.

This greasy and unprepossessing species has become widely established through the tropical regions of the earth.

FORFICULIDÆ.

Chelisochinæ.

Exypnus koorgensis, new species. (Plate XX, figures 14 and 15.)

It is a difficult matter to assign this interesting, though plainly coloured, species to the proper genus. The more slender tarsal joints, with second joint failing to reach the median portion of the third joint, alone prevent its being referred to *Chelisoches*. The tibiæ, which are flattened dorsad in nearly their entire distal half, prevent assignment to *Adiathetus*.

The species, when compared with *E. pulchripennis* (Bormans), may be found to represent a distinct genus. Material of that species is not at present available.

Type: male; Sidapur, Coorg, India. Elevation 3,000 feet. 19th June 1917 (T. R. Naganathan). [Hebard Collection, Type No. 773.]

Size and form medium, close to that of *Chelisoches morio* (Fabricius). Head with frons weakly and lateral portions of occiput decidedly more tumid, separated by the broad deep sutures; caudal margin of occiput moderately concave. Eye three-fifths as long as cheek. Antennæ with eighteen segments; first segment equal to combined length of second, third and fourth; second segment slightly over twice as long as broad; third two-thirds as long as second; succeeding segments increasing slightly in length and slenderness distad, these segments elongate ovoid, not showing the conical tendency found in *C. morio*.

Pronotum slightly longer than wide, lateral margins parallel but curving very weakly to the cephalic angles, caudal margin convex; prozona moderately tumid, with a weak medio-longitudinal impressed line and an impressed point on each side. Tegmina and wings fully developed, smooth, without keels; the former with distal margin weakly concave.

Abdomen supplied with stink glands, those of the second tergite small, of the third tergite prominent; surface impresso-punctulate laterad, this very weak on ultimate tergite. Ultimate tergite as in *C. morio*; roughly bossed above bases of forceps, with a depression between, in which are four small raised points, the median pair being slightly cephalad of the others.

Pygidium vertical, with caudal surface convex. Forceps well separated, cylindrical, elongate, scarcely convex convergent to the incurved apices, which meet; proximad the internal surface of each arm is produced in a heavy, weakly bilobate projection, these projections touch, beyond, the ventro-internal margin is armed with a few sharp, well spaced serrations, the heaviest of which is at base of distal fourth. Penultimate sternite with distal margin evenly and weakly convex, except mesad, where it is weakly and roundly obtuse-angulate emarginate.

Tarsal joints slender, first joint as long as third, second extending beneath third distinctly less than half distance to apex. Ventral surface of caudal metatarsus strongly hirsute, with a few widely placed spines along external margin, which are difficult to detect.

A paratypic male, bearing the same data, except that it was taken two days earlier, shows the brachylabic condition of the species. This condition is so distinct that the following differences should be noted:—

Pronotum distinctly less elongate. Forceps very much shorter, evenly but very weakly convex to the attingent apices; the internal basal projections less proximal, so a brief space intervenes between their proximal margins and the pygidium, more slender, forming a long blunt tooth on each side; beyond the ventro-internal margin is unarmed except for a minute bi-denticulation near end of proximal two-fifths.

Length of body[1] 13 and 12, length of pronotum 2·08 and 1·8, greatest width of pronotum 1·94 and 1·78, length of tegmen 4·1 and 3·7, length of exposed portion of wing 1·75 and 1·5, length of forceps 5·6 and 2·9 mm.

Head, pronotum, tegmina and abdomen blackish chestnut brown, the latter slightly the darkest. Antennæ dark chestnut brown, with thirteenth segment buffy. Exposed portion of wings ochraceous-tawny, broadly suffused with blackish chestnut brown along the external margin. Forceps russet, deepening to chestnut brown distad and with teeth of that colour. Limbs tawny, the femora suffused with chestnut brown in proximal portions.

The species is known from the two males discussed above.

Proreus simulans, (Stâl).

1860. *Forficula simulans*, Stâl, Kongl. Svenska Freg. Eugenie's Resa, I, p. 302. [♂, Java.]

Pusa, Bihar, 30th September to 18th December 1908 and 1915 (two in sugarcane), three males, one female.

[1] The measurements of the macrolabic male type are given first, of the brachylabic male paratype last.

Chaumuhani, Noakhali, Bengal, 29th November 1911 (C. C. Ghosh; light trap in rice field), one male.

In the material here recorded, the pronotal form shows unusual variation in length and in the lateral margins, which in one individual are parallel, but in the others diverge weakly caudad. Such variation is also shown in a Philippine series at hand, the majority from that island having the elongate type, with sides parallel or nearly so.

The males here recorded all have the forceps armed on the ventro-internal margin with a small tooth, situated slightly beyond the median point and another heavier tooth, just before the apex, this margin finely serrulate to the first of these teeth. In the Philippine series the analogous teeth differ not only in position but also in size. The first is larger than the largest in the Indian material and is situated at the end of the median third, while the second is very small and situated just before the apex. This latter tooth is sometimes absent. The ventro-internal margin is instead finely serrulate between these teeth.

The material before us shows clearly that we have an exceptionally variable insect to consider, and we therefore do not feel justified, without a large series from many localities, in recognizing the Indian insect as distinct from the Javan *simulans*, with which our Philippine material fully agrees.

Further embarrassment is caused by the fact that *Forficula modesta* Stâl, described from Hong Kong, has been placed as a synonym of *simulans* by Burr, though having line priority. As *modesta* is described as lacking wings, while all of the material before us has fully developed organs of flight, and may in addition very possibly show other more important differences, we do not believe it advisable, at present and without Chinese material for comparison, to assign *simulans* to synonymy under *modesta*.

Proreus melanocephalus (Dohrn).

1865. *L[obophora] melanocephala* Dohrn, Stettin Ent. Zeit., XXVI, p. 75. [♂, ♀; Tranquebar, India.].

Pusa, Bihar, 7th January to 18th December 1908 to 1918 (on sugarcane, in sugarcane stems bored by borers and inside rice stubble), twelve males, thirteen females, four juv.

Tamkohi, Gorakhpur, United Provinces, 20th April 1910 (H. M. Lefroy), one male.

The dimorphism found in the male sex of this diminutive species is more extensive and striking than in any other form of the Dermaptera known to us. Two conditions are developed, showing great difference not only in the ultimate

dorsal tergite and the pygidium, but in the shape and armament of the forceps as well. As these have not been fully described, we give the following data:—

Type *a*. Five males. Pusa. Ultimate dorsal tergite decidedly thickened caudad, the crest of the blunt ridge thus formed strongly rugose, its caudal face sloping strongly ventrad, with area above pygidium smooth and distinctly, though not strongly, concave. Pygidium vertical, fitting tightly between forceps and apparently roughly quadrate, its exposed caudal surface very weakly convex. Forceps short and heavy, curving to the apices, with a comparatively large, blunt ventro-internal tooth, at end of proximal third.

The forceps vary in heaviness, the arms are weakly bent inward in some of these specimens while the tooth varies in relative size and in some is almost mesal in position.

Type *b*. Eight males. Pusa and Tamkohi. Ultimate dorsal tergite showing only slight convexity above internal portion of bases of forceps, between these narrowly impressed, with caudal margin heavily cingulate. Pygidium very narrowly produced caudad, forming a very narrowly transverse shelf, with (apparent) caudal margin thickened and very weakly concave mesad, from that point with surface suddenly deplanate and so sharply declivent that it lies in a plane sloping ventro-cephalad. The pygidium thus fills the interval between the arms of the forceps, with its apex tucked far beneath the penultimate sternite. Forceps moderately elongate and showing slightly the greatest curvature proximad, armed with a stout dorso-internal tooth just beyond the pygidium and with ventro-internal margin developed in a weak flange to opposite that point, the ventro-internal margin irregularly serrulate to end of proximal two-thirds, the last of these small teeth often distinctly the heavier.

The antennæ have fifteen or sixteen segments in this species.

In specimens showing the greatest contrast of coloration, the first two antennal segments are blackish, the following two segments yellowish brown, the others decidedly darker, though usually paling slightly distad.

Proreus fletcheri,[1] new species. (Plate XX, figures 16 and 17.)

This species is related to *P. melanocephalus* (Dohrn), showing closer affinity to *P. delicatulus* Burr and *P. cunctator* Burr[2] in having two minute but distinct tubercles on the caudal margin of the ultimate tergite.

[1] Named in honour of T. Bainbrigge Fletcher who secured the specimen upon which this species is based and through whose kind co-operation the preparation of the present paper has been made possible.

[2] These species were described in 1911, *Jour. Asiatic Soc. Bengal* (*N. S.*), VII, pp. 789 and 790.

It is very possible that these species should be recognized as generically distinct from *simulans* (Stâl), genotype of *Proreus*. Of these, *fletcheri* is the largest, shows the greatest uniformity of coloration and is apparently further differentiated by the very elongate antennal segments and the flattened head.

Type: male; Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, India. July 1919 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 774.]

Size small, larger than is usual for *melanocephalus*; form rather stout and moderately depressed, slightly stouter and more depressed than in that species. Head decidedly flattened, eyes three-fifths as long as cheeks, sutures broadly impressed; caudal margin of head nearly transverse, not showing the weak but distinct concavity which is found in *melanocephalus*. Antennæ with (sixteen and nineteen) segments, which are much more elongate than in that species; first segment large and nearly as long as combined length of second to fifth segments, second segment minute, third twice as long as broad, fourth two-thirds as long as third, fifth as long as third; distal segments very elongate and slender, fully five times as long as greatest width. Pronotum very slightly longer than wide, with lateral margins sub-parallel and caudal margin very broadly convex; surface with cephalic and lateral portions of prozona very feebly tumid, remaining portions deplanate. Tegmina and wings fully developed.

Abdomen with stink glands distinct, surface more coarsely impresso-punctulate than in *melanocephalus* and supplied with more numerous, heavier hairs. Ultimate tergite weakly tumid above internal portion of forceps, the interval between these weakly impressed, the caudal margin there bearing two minute tubercles which diverge, as they are directed latero-caudad.

Pygidium nearly vertical, directed weakly ventro-cephalad and completely filling space between forceps; its surface flattened, smooth mesad, rugulose laterad, with a very minute tubercle ventrad on each side. Forceps stout, flattened cylindrical, curving from their heavy bases to their sub-attingent apices, this curvature slightly greatest proximad, where, just beyond the pygidium, there is a small, stout tooth situated mesad on the internal surface, connected with the ventral margin proximad by a minute, short ridge. Caudal margin of penultimate sternite weakly concave mesad and weakly convex laterad.

Tibiæ flattened dorsad, cephalic and median tibiæ in distal half, caudal tibiæ in distal third. Caudal metatarsus slightly longer than combined length of second and third joints.

Length of body 9·3, length of first antennal segment 0·75, length of longest distal antennal segment 0·61, length of pronotum 1·53, width of pronotum 1·4, length of tegmen 2·31, length of exposed portion of wing 1·43, greatest width of abdomen 2·24, length of forceps 2·04 mm.

Head and proximal portions of antennæ deep prout's brown, the latter paling to prout's brown distad. Pronotum, tegmina and wings deep prout's brown. Abdomen and forceps blackish chestnut brown. Limbs and underparts prout's brown, excepting the blackish chestnut brown abdomen and forceps.

The type is unique.

Adiathetus tenebrator (Kirby).

1891. *Chelisoches tenebrator* Kirby, Jour. Linn. Soc., Zool., XXIII, p. 521, Pl. XII, fig. 5. [♀, India.]

Pollibetta, Coorg, 24th October to 16th November 1915 (T. Bainbrigge Fletcher; under bark), ten males, four females.

Sidapur, Coorg, 3rd and 12th May 1917 (T. R. Naganathan), two males.

Mercara, Coorg, 15th to 20th October 1915 (T. Bainbrigge Fletcher), one juv.

Coondapur, South Kanara District, 23rd September 1913 (T. V. Ramakrishna Ayyar), one juv.

The male sex of this large black species remained unknown, until described by Burr, in 1911.[1]

As in *Chelisoches morio* (Fabricius), the males develop forceps either dilated in a strong flange in proximal two-fifths, or tapering gradually without flange. Gradations between these types are shown by the series before us, four specimens being of the simple type. The difference in superficial appearance between the extremes is very striking.

The present series shows the following extremes in measurement: length of body, male 13 to 21, female 15 to 20; length of forceps, male 7·3 to 9·4, female 10 to 11·7 mm.

In the adults the antennæ are black, with eleventh and twelfth, or twelfth and thirteenth segments either dark brown or buffy brown. In the immature condition these annuli are much more conspicuous, pale buff.

ANECHURINÆ.

Allodahlia macropyga (Westwood).

1839. *Forficula macropyga* Westwood, in Royle, Illustr. Bot. Nat. Hist. Himalaya Mts., Vol. I, p. LIII, Vol. II, Pl. IX, fig. 12. [♂, ♀; (by inference) Himalayas or India.]

[1] *Jour. Asiatic Soc. Bengal (N. S.)*, VII, p. 791.

Kulu Valley, Kangra, Punjab (M. M. Carleton), one male, four females [Museum of Comparative Zoology, Cambridge].

Amballa, Punjab (M. M. Carleton), one male, one female [Hebard Collection].

Ramgarh, Kumaon Hills, North-Western Provinces, 6,000 feet, 21st to 26th August 1918 (T. Bainbrigge Fletcher), six males, five females.

Masuri, United Provinces, 7,000 feet, October 1906 (H. M. Lefroy), one juv.

Four males have the specialization of the forceps less decided than is normal for the species, this being very pronounced in one of these specimens.

Anechura stoliczkai Burr. (Plate XX, figures 19 and 20.)

1911. *Anechura stoliczkai* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 792. [♂, ♀; Bashahr, Upper Sutlej District, Northern India.]

Kulu, Kangra, Punjab (M. M. Carleton), one male, four females [Museum of Comparative Zoology, Cambridge and Hebard Collection].

Jallore Pass, Kulu, Kangra, Punjab (M. M. Carleton), one male [Museum of Comparative Zoology, Cambridge].

Burr has described the macrolabic condition. The brachylabic male before us not only has very different forceps, but the ultimate tergite has its surface much less specialized distad, while the pygidium is modified and concealed by the much heavier proximo-internal projections of the forceps.

Length of body[1], male 13·5 to 13·5, female 12 to 13; length of pronotum, male 1·84 to 1·63, female 1·53 to 1·7; greatest width of pronotum, male 2·38 to 2·31, female 2·04 to 2·32; length of tegmen, male 3·46 to 3·5, female 3·4 to 3·74; length of exposed portion of wing, male 1·97 to 1·77, female 1·77 to 1·86; length of forceps, male 3·4 to 7·6; female 3·6 to 4·9 mm.

The general coloration is blackish chestnut brown, the abdomen mesoproximad and distad and the forceps being rich chestnut.

The general facies of this insect is very different from that of the other known Indian species of the genus.

FORFICULINÆ.

Elaunon bipartitus (Kirby).

1891. *Sphingolabis bipartitus* Kirby, Jour. Linn. Soc. Zool., XXIII, p. 526. [♂, ♀; India.]

[1] The present material is dried after immersion in alcohol and the body length can, in consequence, only be estimated. In these measurements those for the brachylabic male are given first.

Coimbatore, Madras Presidency, 11th February 1914 (C. S. Misra), one male.

In this specimen the fourth antennal segment is about twice as long as wide and slightly shorter than the third. Burr has discussed this segment in his original description of the genus,[1] but has described it later as "transverse," through a *lapsus calami*.[2]

Length of body 8·8, length of pronotum 1·2, greatest width of pronotum 1·36, length of tegmen 3·35, length of exposed portion of wing 1·5, greatest width of abdomen 2·18, length of forceps 3·2 mm.

Forficula schlagintweiti (Burr). (Plate XX, figures 21 and 22.)

1904. *Anechura schlagintweiti* Burr, Trans. Ent. Soc. London, 1904, p. 313. [♂, ♀: Lahol, Tibet; Darjiling, Northern India.]

1911. *Forficula beebei* Burr, Jour. Asiatic Soc. Bengal (N. S.), VII, p. 795. [♂, ♀; Phallut, Darjiling District (India), at 12,000 feet.]

Eastern Nepal, April, 1910 (C. W. Beebe; from seed pods of a red and yellow lily), two males, two females [Hebard Collection].

Kulu Valley, Kangra, Punjab (M. M. Carleton), two males.

Burr, in his discussion of *beebei*, states that the species is distinguishable from *schlagintweiti* by its lustre and the form of the male pygidium. The former feature is not to be relied on by itself and the pygidial difference we believe to be simply the adaptation of that segment to an Anechuroid type of forceps.

After considering the other Indian species at hand, which show dimorphism in the male sex, and the material here recorded, we are convinced that *beebei* is a synonym of *schlagintweiti*, based on the phase of that species in which the male pygidium shows full and unrestricted development and the forceps an Anechuroid type.

The description of *schlagintweiti* shows the males there considered to be, on the other hand, of the form in which the male pygidium is modified sufficiently to permit the development of a Forficuloid type of forceps.

The gradation between these types of forceps in *schlagintweiti* had been previously noted by Burr.[3]

Of the present material, three males have the pygidium bidenticulate and the forceps Anechuroid, one of these and the two females lack wings. The other specimen, a male from Nepal, has the pygidium bluntly convex, the

[1] *Trans. Ent. Soc. London*, 1907, p. 123 (1907).
[2] Fauna Br. India, Dermaptera, p. 163 (1910).
[3] Fauna Br. India, Dermaptera, p. 166 (1910).

forceps Forficuloid and possesses fully developed tegmina and wings. In this specimen the proximo-internal tooth of the forceps is very large, with broad, flat apex serrulate.

Measurements (in millimeters).

	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Exposed length of wing	Length of forceps
Male—						
NEPAL. Forficuloid	8·0	1·38	1·70	2·79	1·22	2·74
NEPAL. Anechuroid	7·0	1·04	1·45	2·06	..	2·58
KULU. Anechuroid	8·7	1·22	1·45	2·18	1·16	2·79
KULU. Anechuroid	9·8	1·36	1·61	2·31	1·32	3·20
Female—						
NEPAL.	7·8	1·29	1·58	2·18	..	2·18
NEPAL.	8·0	1·32	1·70	2·18	..	2·18

The differences developed in the male forceps are shown by the accompanying figures. Burr has discussed these in his descriptions, the references to which are given above.

In this species the caudal tibiæ are heavy to the median point, whence they taper strongly to their apices. This is due to a conspicuous flattening of the dorsal surface in the area opposable to the caudal metatarsus. This is indicated, but to a lesser degree, on the median tibiæ. We note a short dorso-distal flattening of the caudal tibiæ in other species of the genus, but by no means the striking character shown by *schlagintweiti*.

Forficula lebongae, new species. (Plate XX, figure 23.)

This species is related to *F. schlagintweiti* Burr, but may be quickly distinguished by the nearly semicircular and weakly transverse pronotum; generally somewhat less stocky build; somewhat more slender antennal joints and limbs, and slender, unspecialized tibiæ. Though of the same general type as developed in the Forficuloid condition of that species, the male forceps in *lebongæ* are more evenly curved and show less flattening.

Type: male; Phoobsering, Lebong, Sikkim. Elevation 5,000 feet. October 1910 (H. M. Lefroy). [Hebard Collection, Type No. 781.]

Size medium, form moderately robust. Head weakly convex, sutures obsolete; caudal margin of occiput transverse, showing very faint concavity

mesad. Eye oblique, three-quarters as long as cheek. Pronotum weakly transverse, nearly semicircular, curvature of lateral and caudal margins strongest latero-caudad; median section very feebly tumid in V-shaped area, lateral portions very feebly concave, cephalic angles rounded rectangulate. Tegmina and wings fully developed, smooth and shining, costal margin of the former sharply rounded, caudal margin transverse, truncate. Abdomen with glandular folds of third tergite very weak, of fourth tergite well developed; surface strongly impresso-punctulate, this weak on proximal tergites. Ultimate tergite four times as wide as long, lateral margins weakly convergent caudad, surface weakly tumid distad above bases of forceps, weakly concave between and on each side.

Pygidium small and inconspicuous, directed ventro-caudad; exposed face semicircular, smooth, but with a linear sulcus paralleling and just within the free margin; apex ventrad, concealed. Forceps at immediate base with internal portion thickened into a very short flange, better described as a heavy, blunt tooth, the broad flattened apex of which bears a few minute, irregular, blunt denticulations; arms there touching, from that area convex to the apices, so that in major portion they are rather strongly and evenly bowed. Penultimate tergite with free margins straight, convergent to the bluntly rounded apex. Limbs slender and moderately elongate, caudal metatarsus equal in length to the two succeeding segments.

Length of body 9·2, length of pronotum 1·24, greatest width of pronotum 1·59, length of tegmen 2·31, dorsal width of tegmen 1·26, length of exposed portion of wing 1·43, greatest width of abdomen 2·52, length of forceps 2·74, length of margin of proximo-internal flange (or tooth) of forceps 0·36, length of caudal femur 2·24, length of caudal tibia 1·9 mm.

Head and pronotum blackish brown, the sides of the latter paler. Tegmina, wings and sides of pronotum prout's brown, translucent and cinnamon brown when held to the light. Abdomen bay, the ultimate tergite, glandular folds and narrow proximal portions of other tergites darkened. Forceps in enlarged proximal portions bay, remaining portions blackish brown. Limbs bay, paling to buckthorn brown in distal portions.

The type is unique.

Forficula beelzebub (Burr).

1900. [*Chelisoches*] *beelzebub* Burr, Ann. Soc. Ent. Belgique, XLIV, p. 51. [♂; Kurseong, Bengal, India.]

Kurseong, Bengal, (from C. Leigh), twenty-one males, ten females, one juv.

Among the males, one has the forceps deformed and lacking a proximo-internal flange; another has the dextral arm only slightly over half as long as the sinistral arm and unspecialized; while a third has the dextral arm very similar to the characteristic condition developed in the female sex.

The present series does not show much individual variation, the extremes being as follows: length of body, male 9·5 to 11, female 12·2 to 13; length of pronotum, male 3 to 3·2, female 1·77 to 1·9; greatest width of pronotum, male 2·13 to 2·3, female 2·48 to 2·5; length of tegmen, male 3 to 3·2, female 3·33 to 3·53; length of exposed portion of wing, male 1·18 to 1·6, female 1·5 to 1·56; length of forceps, male 3·9 to 4, female 3 to 3·2; length of proximo-internal flange of male forceps 1·09 to 1·18 mm.

Forficula acris (Burr).

1905. *Forficula acer*[1] Burr, Jour. Asiatic Soc. Bengal (N. S.), I, p. 30. [♂; Mung Phu, Sikkim.]

1905. *Forficula celer* Burr, Jour. Asiatic Soc. Bengal (N. S.), I, p. 31. [♂, ♀; Khasi Hills (Assam), India.]

Kulu, Kangra, Punjab (M. M. Carleton), one female [Museum of Comparative Zoology, Cambridge].

Shillong, Khasi Hills, Assam, 5,000 feet, April to October 1916 to 1920 (Fletcher and Rao; four on apple blossoms and shoots, four on rose flowers), twenty males, seventeen females.

Ramgarh, Kumaon Hills, North-West Provinces, 6,000 feet, 21st to 26th August 1918 (T. Bainbrigge Fletcher), one female.

The present large series from Shillong furnishes convincing evidence of the synonymy indicated above. Burr has described a macrolabic male as *acer*[2] and a brachylabic male of the same species as *celer*.[3]

A single specimen from Shillong is strongly macrolabic. In this specimen the pronotum is appreciably more transverse, the pygidium decidedly more elongate and the forceps broader proximad and much more elongate, with proximo-internal flange terminating in a sharp tooth. From examination of the macrolabic and brachylabic phases developed in three other species of the genus before us, we find that the pronotum is normally slightly broader in the former than in the latter condition of the same species.

This insect shows decided variation not only in size but also in coloration.

[1] Burr, later realizing that this name did not agree in gender with *Forficula*, changed it to *aceris*. The feminine of the Latin adjective *acer* is, however, *acris*.

[2] See Burr's discussion and figure, Fauna. Br. India, Dermaptera, p. 168, and Pl. VII. fig. 57.

[3] *Ibid.*, p. 172 and Pl. VII, fig. 60.

Measurements (in millimeters) of specimens from Shillong.

Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of exposed portion of wing	Length of forceps	Length of margin of proximo-internal flange of forceps
Male—						
7·8	1·22	1·50	2·58	1·16	3·24	1·02
7·9	1·25	1·50	2·45	1·16	3·60	1·16
9·0	1·46	1·73	2·70	1·25	3·60	1·22
10·0[1]	1·52	1·80	2·92	1·32	4·70	1·36
10·7	1·52	1·80	2·90	1·32	6·10	1·63
10·5	1·50	1·85	2·92	1·20	7·60	1·80
Female—						
8·8	1·34	1·60	2·55	1·06	2·86	..
9·7	1·40	1·70	2·79	1·25	3·00	..

In this species the male pygidium is convex declivent, terminating in a brief horizontal flange, the apex truncate and, in the brachylabic phase, distinctly narrower than the horizontal distance occupied by the pygidium. In the macrolabic phase the pygidium is decidedly more elongate and proportionately more slender.

Three males and one female have one of the arms of the forceps much shorter than the other, deformed, in the males lacking the proximo-internal flange.

The majority of the series are shining blackish brown, the head and forceps slightly paler and more reddish, the tegmina and wings decidedly paler, sandford's brown, darkening gradually laterad and distad. In some specimens the head is as dark as the pronotum.

The smallest male from Shillong shows a distinctive colour phase. The head is ochraceous tawny, the pronotum blackish brown and the tegmina and wings clay colour. The abdomen is chestnut brown proximad paling to hazel distad, with distal extremity blackish brown. The forceps are rich chestnut brown, the limbs dark. The female from Kulu is an even more striking example of this contrastingly coloured phase, agreeing with the male except that the

[1] The majority of the males before us agree more nearly with this individual.

head is light ochraceous tawny, the tegmina and wings antimony yellow, with pronotum very narrowly marked with this colour laterad.

Forficula interrogans Burr.

1905. *Forficula interrogans* Burr, Ent. Mo. Mag. (2), XVI, p. 85, (♂; Darjiling, India.]

Kurseong, Northern Bengal (from C. Leigh), one male, six females.

We are by no means satisfied that *interrogans* will not eventually prove to be a synonym of *planicollis* (Kirby)[1]. The present material fits decidedly more closely Burr's analysis of *interrogans*[2] than it does his discussion of *planicollis*[3] and, without more material, we believe that we should therefore record it as such.

Length of body, male 6·1, female 6 to 7·3; length of pronotum, male 1·1, female 1·09 to 1·15; greatest width of pronotum, male 1·39, female 1·34 to 1·4; length of tegmen male 2·2, female 2·13 to 2·24; length of exposed portion of wing, male 0·88, female 1·02 to 0·61; length of forceps, male 2, female 1·7 to 1·57, length of margin of proximo-internal flange of male forceps 0·54 mm.

OPISTHOCOSMIINÆ.

Sadiya, new genus.

This genus is erected to include the new species, *S. grata* here described, and the African *pœcilocera* (Borg)[4]. It is nearest in relationship to *Dinex*[5] Burr and *Thalperus* Burr[6].

These genera agree in having fully developed tegmina which lack keels, ultimate male tergite narrow, narrowing and sloping decidedly caudad, pronotum approximately as broad as long and caudal metatarsus slightly longer than the combined length of the succeeding joints, though appreciably less than twice as long as the third joint.

We agree fully with Burr in his definition of *Opisthocosmia* in its restricted sense. The genotype, *O. centurio* Dohrn, may be readily distinguished from

[1] Described from a female from North India, *Jour. Linn. Soc. London*, XXIII, p. 525, (1891).

[2] Fauna Br. India, Dermaptera, p. 173, Pl. VII, fig. 61.

[3] *Ibid.*, p. 174.

[4] A male before us from the Belgian Congo, belongs to the Philadelphia Academy. Originally referred to the genus *Ancistrogaster*, Burr has assigned the species, with a query, to *Opisthocosmia*.

[5] Comparison is made with two males and a female of the genotype, *D. americanus* (Bormans), from Guatemala and Panama, in the Hebard Collection.

[6] Comparison is made with a male of the genotype, *T. kuhlgatzi* (Burr), from the Belgian Congo, in the collection of the Philadelphia Academy.

Sadiya by its very large size, pronotum which is very much longer than wide (though it agrees in being narrower caudad than cephalad), the very elongate limbs and ultimate male tergite which is strongly transverse and scarcely narrows caudad.[1]

From *Dinex* the present genus differs in its more compact, less elongate form, head more evenly tumid (without a marked or extensive concave area mesad on the occiput), decidedly shorter antennal segments, pronotum with lateral margins convergent caudad throughout (not very weakly convex and convergent caudad only in caudal two-thirds), decidedly shorter limbs and caudal metatarsus decidedly longer than the last joint (not equalling that joint in length). In contour these genera agree very closely except for the general decidedly greater attenuation and more intricate specialization of the male forceps in *Dinex*. This similarity is particularly emphasized by the striking smallness of the pronotum, when compared with the size of the head and tegmina.

From *Thalperus* the present genus differs in showing not even weak flattening, in the somewhat tumid head, more elongate antennal segments and proportionately decidedly smaller pronotum with greatest width cephalad and lateral margins convergent caudad (not feebly convex and sub-parallel).[2]

Though showing nearer affinity to *Dinex* in general contour, *Sadiya* agrees with *Thalperus* in the greater number of characters which are used to separate the genera of this sub-family.

Genotype. *Sadiya grata*, new species.

Generic description. Size small for the subfamily, form slender and showing no flattening. Head moderately tumid with sutures sub-obsolete. Antennæ with segments moderately elongate, fourth segment slightly longer than third. Pronotum very small, length approximating width, lateral margins convergent caudad so that the cephalic is distinctly greater than the caudal width, caudal margin convex. Tegmina and wings fully developed; the former broad, full and with dorsal surface weakly convex, lacking keels, caudal margin transverse, truncate.

[1] We are able to determine this from the following material of *O. centurio* Dohrn, kindly loaned to us from the Burr Collection, by the British Museum:—

Borneo (Freivaldsky), one male, see Plate XXI, figure 24.

Padang Pandjang, Western Sumatra (from H. Rolle), one female.

See also Bormans, Das Tierreich, XI, p. 95, fig. 36*a*, *b* and *c*, (19), and Burr, Gen. Ins., Dermaptera, Fasc. 122, p. 92, Pl. IX, figs. 13, 13*a* and 13*b* (1911).

[2] For some unknown reason Burr has placed the genus *Thalperus* in his key in the category in which the ultimate male tergite is transverse, rectangular and rather depressed, Gen. Ins., Dermaptera, Fasc. 122, p. 89 (1911). This is incorrect, as shown by the specimen of *kuhlgatzi* before us.

Abdomen with surface decidedly convex, glandular folds of second tergite small, of third tergite very large, greatest width meso-caudad, ultimate tergite narrow, tapering and strongly declivent caudad in both sexes. Male forceps sub-attingent throughout, nearly straight, without large teeth ; female forceps more slender and straight to the weakly incurved apices. Limbs moderately elongate, caudal metatarsus longer than combined length of succeeding joints, third joint appreciably shorter.

Sadiya grata, new species. (Plate XXI, figures 25 and 26.)

This handsome little insect is readily distinguished from *S. pœcilocera* (Borg) by its distinctive coloration and the unusual contour of the forceps.

Type : male ; Sadiya, Assam, 21st to 25th May 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 777.]

In addition to the characters given in the generic description, we note the following : Eye slightly longer than cheek. Head with caudal margin of occiput transverse, showing only a trace of emargination. Pronotum with cephalic angles rectangulate ; prozona moderately tumid, narrow lateral portions moderately reflexed ; lateral margins convergent caudad and almost straight, showing very weak convexity, rounding into the moderately convex caudal margin. Width of each tegmen slightly greater than greatest width of pronotum.

Abdominal tergites very minutely tuberculose laterad, except ultimate tergite which is smooth and polished, weakly tumid above the forceps with area between impressed, its caudal margin showing very weak concavity mesad. Pygidium vertical, with caudal face produced as a small, bluntly conical projection. Forceps sub-attingent, showing a weak bisinuation with acute apices overlapping when in normal position ; dorsal surface weakly convex ; weakly flattened at ventro-internal margin in proximal third and supplied with very minute teeth, thence the internal surface is weakly longitudinally striate to the apex ; ventral surface deplanate proximad, becoming shallowly concave on internal half of distal portion. Penultimate sternite with caudal margin broadly convex. Third joint of caudal tarsus three-quarters as long as the metatarsus.

Allotype : female ; same data as type. [Hebard Collection.]

Agrees closely with male in ambisexual characters, differing as follows. Abdomen slightly heavier, the tergites only slightly roughened laterad, the ultimate tergite similar but with caudal margin mesad showing a narrower but stronger emargination, which is roundly obtuse-angulate. Pygidium similar. Forceps about as long as in male but decidedly more slender, separated

by a brief interval and straight to the weakly incurved apices. Arms of forceps tapering rapidly from base to median portion, thence very slender and weakly tapering; roundly triquetrous in proximal portions, where the ventro-internal margin is very weakly sub-lamellate and sub-crenulate; ventral surface deplanate, longitudinally sub-striate, with margins weakly sub-cingulate, particularly in the median portion.

Length of body, male 7·2[1] to 8, female 8 to 8·2; length of pronotum, male 0·95 to 1·02, female 1·05 to 1·11; cephalic width of pronotum, male 1·02 to 1·12, female 1·16 to 1·09; caudal width of pronotum, male 0·95 to 1·02, female 0·98 to 0·95; length of tegmen, male 2·18 to 2·52, female 2·58 to 2·45, length of exposed portion of wing, male 1·1 to 1·36, female 1·29 to 1·16; width across tegmina, male 2·04 to 2·18, female 2·18 to 2·11; greatest width of abdomen, male 1·84 to 2·15, female 2·25 to 2·34; length of forceps male 2·72 to 2·86, female 2·65 to 2·8 mm.

Head, pronotum and abdomen (except laterad) kaiser brown, the pronotum apparently darker caudad, due to its translucence there and the darker colour of the tegmina beneath. The sides of the thoracic segments are blackish and the abdomen becomes blackish laterad, with the glandular folds black. Antennæ mars brown with ninth or tenth (terminal[2]) segment buffy. Tegmina chestnut brown, with a broad longitudinal paler area (antimony yellow in the type, tawny in the other specimens) extending caudad fully half the distance to the caudal margin. The outline of this marking is vague. Exposed portion of wings chestnut brown in internal half, antimony yellow in external half, the apex of the pale area roundly terminating and situated before the apex of the wing. Forceps in the males chestnut brown, paling to russet proximad and distad; in the females russet. Underparts russet. Limbs immaculate, ochraceous tawny.

In addition to the type and allotype, a paratypic pair are at hand, taken at Margherita, Assam, 14th to 19th May 1920, by T. Bainbrigge Fletcher.

Prosadiya, new genus.

This genus includes the single species, *P. tricota*, here described. In general appearance it resembles *Sadiya*, the forceps being likewise unusually simple and straight for the subfamily, but longer and more slender, in that respect showing closer similarity to *Dinex*. The pronotum in *Prosadiya* is,

[1] The measurements of the type male and allotype female are given first, those of a paratypic pair last.

[2] The antennæ may be incomplete in the three specimens before us showing the buffy terminal segment.

however, much larger in proportion to the body bulk than in those genera, in this feature showing closer agreement with *Thalperus*.

Nearest relationship is shown to *Sadiya*. These genera agree in general contour, in having fully developed organs of flight, tegmina without keels, ultimate male tergite narrow and narrowing caudad, pronotum approximately as broad as long and caudal metatarsus slightly longer than the combined length of the succeeding joints.

The present genus differs from *Sadiya* in being decidedly hirsute, in having the frons moderately and lateral portions of occiput decidedly tumid and separated by deep sutures, the pronotum larger in proportion to the size of the head and with lateral margins weakly divergent caudad, ultimate male tergite sloping moderately caudad and caudal metatarsus distinctly less than twice as long as the third joint.

Genotype.—*Prosadiya tricota*, new species.

Generic description. Size small for the subfamily, form slender and showing no flattening, surface decidedly hirsute. Head with frons moderately and lateral portions of occiput decidedly tumid and separated by deep sutures. Antennæ with segments moderately elongate for the subfamily, somewhat more elongate than in *Sadiya*, third segment approximating fourth in length.

Pronotum medium small, length approximating width, lateral margins weakly divergent caudad so that the cephalic is appreciably less than the caudal width, caudal margin convex. Tegmina and wings fully developed; the former moderately broad and with dorsal surface weakly convex, lacking keels, caudal margin transverse truncate. Abdomen with surface convex, glandular fold of third tergite minute, of fourth tergite large. Male forceps sub-attingent throughout, straight to the weakly incurved apices, without teeth. Limbs moderately elongate, caudal metatarsus longer than combined length of succeeding joints, third joint distinctly shorter than metatarsus.

Prosadiya tricota, new species. (Plate XXI, figure 27.)

Though superficially somewhat resembling *Sadiya grata* here described, the present insect is seen, on closer examination, to differ very widely in the generic features discussed above, as well as in the more elongate and slender male forceps, the strikingly bicolored head and different tegminal marking.

Type: male; Dibrugarh, Assam, 13th May 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 778.]

The following characters are important in defining the species, in addition to those given in the generic discussion: Eye slightly longer than cheek. Head with caudal margin of occiput transverse, showing only a trace of

emargination. Pronotum with cephalic angles very slightly more than rectangulate; prozona moderately tumid, lateral portions moderately reflexed, though not as much as in *S. grata;* lateral margins very weakly divergent caudad and almost straight, showing very faint convexity, rounding into the rather broadly convex caudal margin. Width of each tegmen appreciably less than least width of pronotum.

Entire abdominal surface very minutely pitted, these the bases of very fine hairs which cover the entire insect and give it a fuzzy appearance, these hairs being even more numerous on the abdomen than elsewhere; ultimate tergite not as narrow and not as decidedly declivent caudad as in *S. grata*, surface evenly convex except for twin, faintly concave areas meso-caudad, with a very short, longitudinal, median, impressed line proximad between these.

Pygidium declivent, sloping ventro-caudad, narrow and fitting tightly between the arms of the forceps, with caudal face deplanate. Forceps attingent beyond the very narrowly separated bases, elongate, slender and straight to the very broadly incurved acute apices, which in normal position overlap; simple and cylindrical except for a very low delicate, rounded ridge on the dorso-internal margin, which, directed meso-dorsad, runs from the basal fourth to near the base of the forceps. This ridge develops rapidly proximad, then weakens and disappears gradually distad, while the dorso-internal margin distad and the greater portion of the ventro-internal margin is defined by a very fine raised line. Penultimate sternite with caudal margin broadly convex. Third caudal tarsal joint two-thirds as long as the metatarsus.

Length of body 6·3, length of pronotum 1·12, cephalic width of pronotum 1·02, caudal width of pronotum 1·19, length of tegmen 2·29, length of exposed portion of wing 1·12, width across tegmina 1·95, greatest width of abdomen 1·74, length of forceps 3·44 mm.

Head with frons and mouthparts blackish chestnut brown, occiput cinnamon-rufous in sharp contrast. Eyes black. Pronotum with prozona cinnamon-rufous, the remaining lateral and caudal portions transparent, buffy yellow. Tegmina mars brown, with an oval spot of antimony yellow meso-proximad in the dorsal field. Exposed portion of wings antimony yellow, broadly suffused with mars brown in proximal half of sutural margin, this suffusion sub-obsolete beyond, but running diagonally to the external angle of the tip, where it again becomes distinct. Abdomen tawny proximad, rapidly deepening to mars brown in distal portions. Forceps ochraceous tawny, ventral surface slightly darker. Limbs clear translucent buffy yellow.

The type of this remarkable earwig is unique.

Pareparchus pelvimeter, new species. (Plate XXI, figure 28.)

Though small for the subfamily, this insect is very much larger than the genotype, *P. minusculus* (Bormans).

These species are quickly distinguished from the other known forms of the Opisthocosmiinæ by the comparatively short antennal segments, transverse and almost semicircular pronotum and transverse ultimate tergite of the male.

Type: male; Hansey Estate, Sanivarsandai, Coorg, India, 29th to 30th April 1913 (T. V. Ramakrishna Ayyar). [Hebard Collection, Type No. 780.]

Size small for the subfamily, form slender. Head weakly convex, sutures sub-obsolete, caudal margin of occiput transverse, with only a trace of convexity on each side. Eye small, only three-fifths as long as cheek. Antennæ with segments comparatively short, first as long as second, third and two-thirds of fourth, second quadrate, third slightly over twice as long as second, fourth as long as third, fifth decidedly longer and showing a decidedly pyriform tendency.

Pronotum semicircular, distinctly broader than long; prozona weakly tumid, other portions deplanate, except for the lateral portions, which are very weakly reflexed. Tegmina and wings fully developed; the former without keels, with caudal margin transverse and showing very faint concavity. Abdomen slightly the widest meso-distad, almost parallel-sided; glandular folds of third tergite very small and poorly developed, of fourth tergite represented by low, rounded knobs; surface impresso-punctulate, these weak dorso-proximad and very decided on the four distal tergites laterad. Ultimate tergite transverse, sloping moderately caudad, the lateral margins showing very weak convergence caudad; surface impresso-punctulate but with four narrow longitudinal smooth areas, very weakly tumid distad at bases of forceps with caudal margin bluntly produced there, weakly concave between and on each side with caudal margin there weakly concave.

Pygidium vertical, showing mesad a slight flexure ventro-cephalad, its surface smooth. Forceps showing an inward curvature at base, becoming attingent, thence evenly diverging to distal portions, which are curved inward so that the apices meet; armed just beyond area of contact with a very large, blunt, dorsal tooth, which is directed dorso-caudad, with base strongly longitudinal. The arm is flattened dorsad in brief proximal portion before this tooth and rounded but showing a quadrate tendency in distal portions, due to a weak flattening of the internal surface and the very weak convexity of the dorsal surface. Surface of forceps with minute scattered impressed punctæ, except on internal surface to beyond median point and ventral surface proximad, where minute tubercles occur, the ventro-internal margin armed with heavier

minute blunt teeth along area of contact and with fewer small tubercles to beyond median point. Penultimate sternite with distal margin convex, the convexity strongest mesad, rather decidedly hirsute in distal portion. Limbs rather short and slender. Caudal metatarsus equal in length to third joint and pilose ventrad, second joint strongly dilated.

A paratypic male before us shows a more strongly macrolabic type. The forceps are more elongate, with the large dorsal tooth, the small blunt ventro-internal teeth and the minute tuberculations all more decided.

Length of body[1] 8·3 to 9[2], length of pronotum 0·88 to 1·16, greatest (cephalic) width of pronotum 1·18 to 1·1, length of tegmen 2·27 to 2·52, width across tegmina 1·9 to 2, length of exposed portion of wing 1·16 to 1·18, greatest width of abdomen 2·05 to 2·11, length of forceps 2·82 to 3·55, length of tooth of forceps 0·38 to 0·61 mm.

Head, abdomen and forceps shining blackish chestnut brown. Antennæ and tegmina dark chestnut-brown. Pronotum with prozona very dark, shining, chestnut brown, the lateral and caudal portions translucent honey yellow, caudad of the prozona tinged with brown. Exposed portions of wings honey yellow, rather broadly suffused about the free margins with brown, except at the proximo-internal portion of the apex. Limbs buff, tinged with tawny, the tibiæ suffused with chestnut brown to near their apices, the caudal femora suffused with chestnut brown in proximal two-thirds. The median femora also show a trace of brown suffusion in proximal two-thirds. The paratype is similar in coloration, though slightly more recessive with proximal abdominal tergites becoming chestnut brown proximad and suffusions on the limbs weaker.

In addition to the type, a paratypic male is before us, taken at Manantoddy, Wynaad, at 2,500 feet, on 16th November 1917 by Y. R. Rao.

Eparchus inermis, new species. (Plate XXI, figure 29.)

This insect agrees closely with *E. insignis* (Haan) in size, colour, pattern and form, except that in the male the abdominal tergites are unspecialized laterad and the forceps are weakly bisinuate and entirely lack large teeth or projections. The individual at hand is also darker than any of the specimens of *insignis* before us.

The species in many ways resembles *Narberia simplex* (Bormans)[3], that insect being larger, with pronotum longer than broad, the sides of the fifth to

[1] The measurements of the type are given first.

[2] This specimen is distended. The length is, therefore, estimated.

[3] Described in 1894, later diagnosed by Burr, from material of the type series as *Hypurgus simplex*, Fauna Br. India, Dermaptera, p. 189, (1910).

eighth tergites recurved and sharp when seen from above and the forcep shorter.

Type: male; Shillong, Khasi Hills, Assam, October 1920 (T. Bainbrigge Fletcher). [Hebard Collection, Type No. 779.]

Size medium for the genus. Head with frons moderately tumid and showing two impressed points between the eyes, occiput with an irregular transverse impression meso-caudad as in *insignis*. Pronotum with length nearly equal to width, greatest width meso-cephalad, lateral and caudal margins very broadly convex; prozona moderately tumid, with a medio-longitudinal linear sulcus and an impressed point mesad on each side, lateral portions moderately reflexed, caudal portion deplanate. Tegmina and wings fully developed; the former much wider than the pronotum, lacking keels, full, with dorsal surface weakly convex and caudal margin transverse.

Abdomen with surface very minutely punctulate, except ultimate tergite which is smooth; glandular folds of third tergite medium, of fourth tergite large, the other tergites unspecialized, fifth and sixth increasing in width, the seventh, eighth and ninth decreasing more rapidly in width and telescoping as the abdomen rapidly narrows. Ultimate tergite as in *insignis;* narrow, narrowing and decidedly declivent caudad, with surface tumid distad above arms of forceps and concave between.

Forceps elongate and slender, arms weakly convergent until they touch proximad, thence curving very weakly and diverging until separated a distance slightly more than the width of one of the arms, where they curve broadly inward to the overlapping, acute apices. Arms cylindrical, with a sub-obsolete low rounded ridge along the ventro-internal margin proximad, with a median row of very minute, widely spaced denticulations along the internal surface and slightly thickened ventro-mesad toward the apex, this the vestige of the homologous tooth found in *insignis*. Penultimate sternite with caudal margin very broadly convex. Caudal metatarsus very elongate, third joint three-fifths as long as metatarsus.

Length of body 9·3, length of pronotum 1·43, greatest (meso-cephalic) width of pronotum 1·54, length of tegmen 3·2, dorsal width of tegmen 1·4, length of exposed portion of wing 1·56, greatest width of abdomen 2·92, length of forceps 6·1, length of caudal metatarsus 1·09, length of third caudal tarsal joint 0·75 mm.

Head, proximal antennal segments (the others are missing), pronotum and limbs shining blackish, showing scarcely a tinge of brown. Tegmina and wings blackish chestnut brown, the latter with a large meso-proximal spot of mustard yellow. Abdomen blackish chestnut brown, the tergites and sternites

laterad and in meso distal portions almost black. Forceps chestnut brown, except in thickened portion before the apex, which is blackish.

The type is unique.

Eparchus insignis (Haan).

1842. *Forficula insignis* Haan, in Temminck, Verh. Nat. Gesch. Nederlandsche Overzeesche Bezittingen, Orth., p. 243, Ins. Pl. 23, fig. 14. [♂, ♀; Java.]

Phoobsering, Lebong, Sikkim, 5,000 feet, September 1910 (H. M. Lefroy), one female.

Pollibetta, Coorg, 24th October to 16th November 1915 (T. Bainbrigge Fletcher), one male.

Sidapur, Coorg, 7th August 1917 (Y. R. Rao), one female.

Yercaud, Shevaroy Hills, Madras Presidency, 3,000 to 5,000 feet, 9th August 1917, (Y. R. Rao), one female.

In the male only, of the present material, do the exposed portions of the wings show conspicuously the yellow proximo-internal spot and the line of the same colour along the sutural margin at the apex.

Timomenus oannes (Burr).

1900. *Opisthocosmia oannes* Burr, Ann. Mag. Nat. Hist., (7), VI, p. 85. [♂, Assam.]

Shillong, Khasi Hills, Assam, 5,000 feet, 31st May to October 1916 to 1919 (Fletcher and Rao), five males, four females.

The wings of this very handsome species, when expanded, are seen to be deep chrome, suffused with black in the distal portions.

Length of body, male 11·7 to 14, female 10·8 to 12; length of pronotum, male 1·56 to 1·77, female 1·65 to 1·7; greatest (meso-cephalic) width of pronotum, male 1·77 to 1·97, female 1·9 to 1·88; length of tegmen, male 3·2 to 3·5, female 3·5 to 3·55; length of exposed portion of wing, male 1·36 to 1·56, female 1·43 to 1·63; length of forceps, male 5 to 7, female 6·4 to 6·4 mm.

LIST OF ILLUSTRATIONS

Plate XIX.

Fig. 1. *Diplatys bicoloripes*, new species. Male, *type*. Nagpur, Central Provinces, India. Dorsal view. (× 6·66.)

„ 2. *Diplatys bicoloripes*, new species. Male, *type*. Nagpur, Central Provinces, India. Ventral view of distal portion of abdomen and forceps. (Much enlarged.)

„ 3. *Paralabis greeni* (Burr). Male, *type*. Pundalu-oya, Ceylon. Dorsal view of ultimate tergite and forceps. (Much enlarged.)

„ 4. *Paralabis castetsi* (Bolivar). Male. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 3.)

„ 5. *Epilabis penicillata* (Borelli). Male. Ootacamund, Nilgiri Hills, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 3.)

„ 6. *Epilabis penicillata* (Borelli). Male. Ootacamund, Nilgiri Hills, India. Ventral view of penultimate sternite, showing its distinctive specialization. (Much enlarged.)

„ 7. *Nala lividipes* (Dufour). Male. Pusa, Bihar, India. Dorsal view of ultimate tergite and forceps. (Much enlarged.)

„ 8. *Nala lividipes* (Dufour). Male. Haripur Hazara, North-West Frontier Province. Dorsal view of ultimate tergite and forceps. (Same scale as figure 7.)

„ 9. *Nala lividipes* (Dufour). Male. Pusa, Bihar, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 7.)

„ 10. *Chætospania kurseongæ*, new species. Male, *type*. Kurseong, Northern Bengal, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 11. *Chætospania kurseongæ*, new species. Female, *allotype*. Kurseong, Northern Bengal, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

„ 12. *Chætospania stiletta* Burr. Male. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

Fig. 13. *Chætospania stiletta* Burr. Female. Kodaikanal, Madras Presidency, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 10.)

Plate XX.

Fig. 14. *Exypnus koorgensis*, new species. Male, *type*. Sidapur, Coorg, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 15. *Exypnus koorgensis*, new species. Male, *paratype*. Brachylabic condition. Sidapur, Coorg, India. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 14.)

„ 16. *Proreus fletcheri*, new species. Male, *type*. Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 17. *Proreus fletcheri*, new species. Male, *type*. Goalundo to Gauhati, Brahmaputra River, Eastern Bengal, India. Lateral outline of distal antennal segments. (Greatly enlarged.)

„ 18. *Cranopygia pluto*, new species. Male, *type*. Chin Hills, Burma. Dorsal view. (× 3·3.)

„ 19. *Anechura stoliczkai* Burr. Male. Kulu, Kangra, Punjab, India. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 20. *Anechura stoliczkai* Burr. Male. Brachylabic condition. Jallore Pass, Kulu, Kangra, Punjab, India. Dorsal view of ultimate tergite and forceps. (Same scale as figure 1.)

„ 21. *Forficula schlagintweiti* Burr. Male. Anechuroid forceps. Eastern Nepal. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 22. *Forficula schlagintweiti* Burr. Male. Forficuloid forceps. Eastern Nepal. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 21.)

„ 23. *Forficula lebongae*, new species. Male, *type* Phoobsering, Lebong, Sikkim. Dorsal view of ultimate tergite, pygidium and forceps. (Same scale as figure 21.)

Plate XXI

Fig. 24. *Opisthocosmia centurio* Dohrn. Male. Borneo. Lateral view of distal portion of abdomen and forceps. (Much enlarged.)

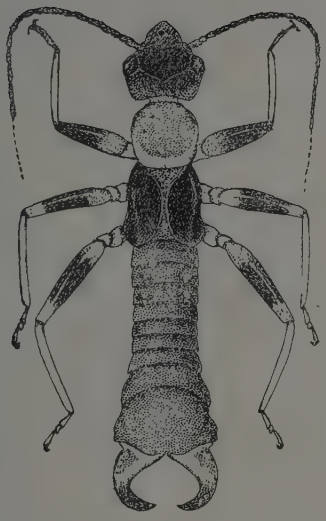
„ 25. *Sadiya grata*, new species. Male, *type*. Sadiya, Assam. Dorsal view, (× 6·66.)

Fig. 26. *Sadiya grata*, new species. Female, *allotype*. Sadiya, Assam. Dorsal view of ultimate tergite, pygidium and forceps. (Much enlarged.)

„ 27. *Prosadiya tricota*, new species. Male, *type*. Dibrugarh, Assam. Dorsal view. (× 6·66.)

„ 28. *Pareparchus pelvimeter*, new species. Male, *type*. Hansey Estate, Coorg, India. Dorsal view. (× 6·66.)

„ 29. *Eparchus inermis*, new species. Male, *type*. Shillong, Khasi Hills, Assam. Dorsal view of ultimate tergite and forceps. (Much enlarged.)



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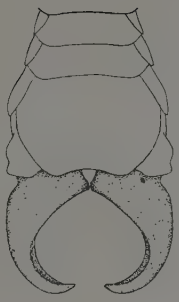

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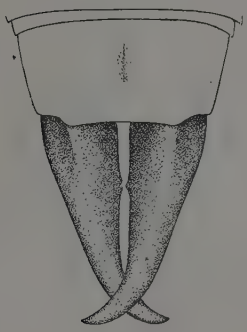

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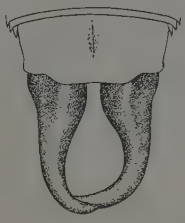

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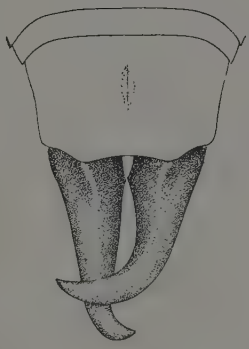

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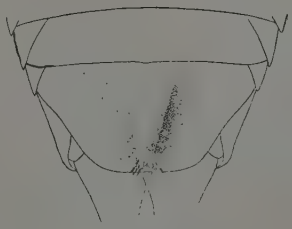

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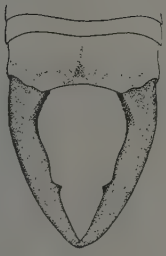

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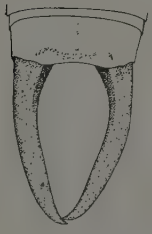

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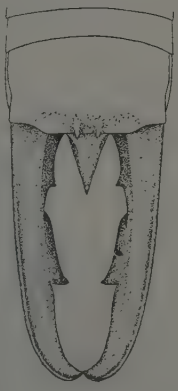

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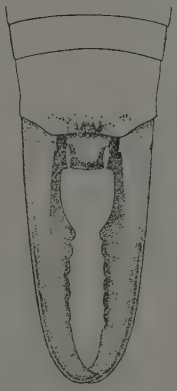

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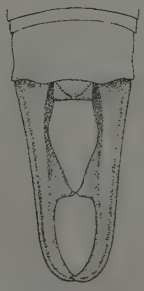

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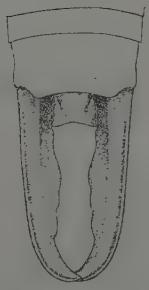

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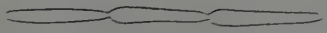

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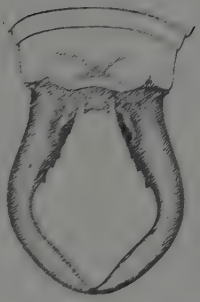

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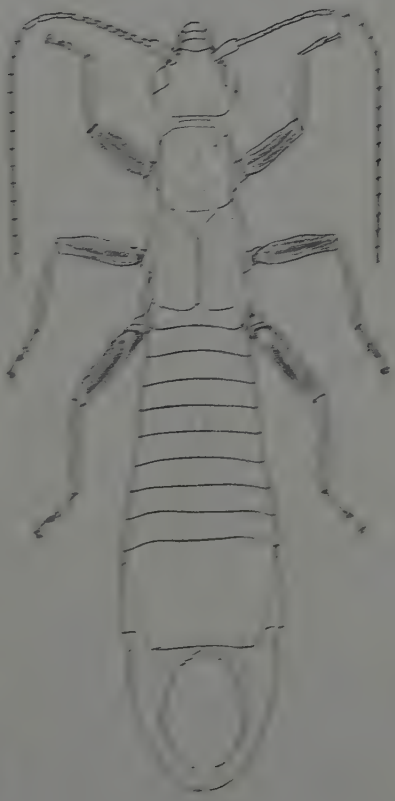

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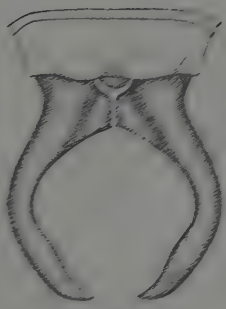

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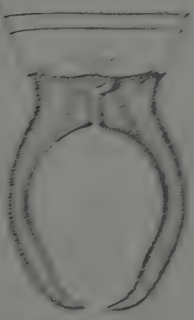

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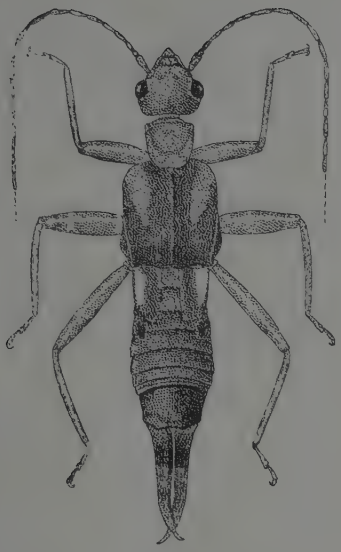

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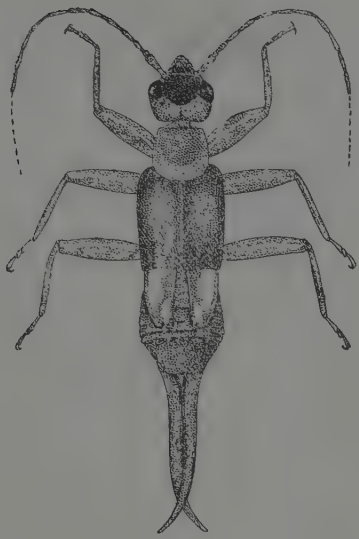

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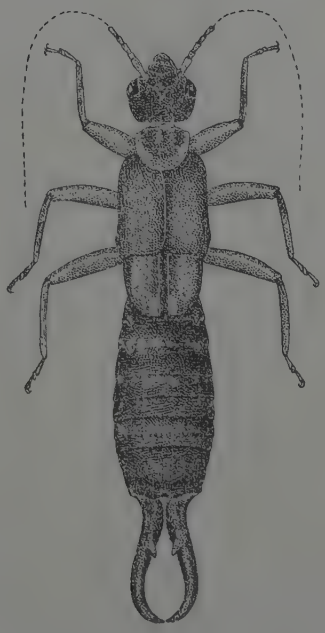

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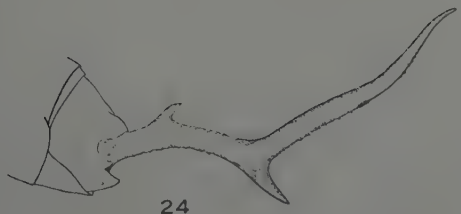

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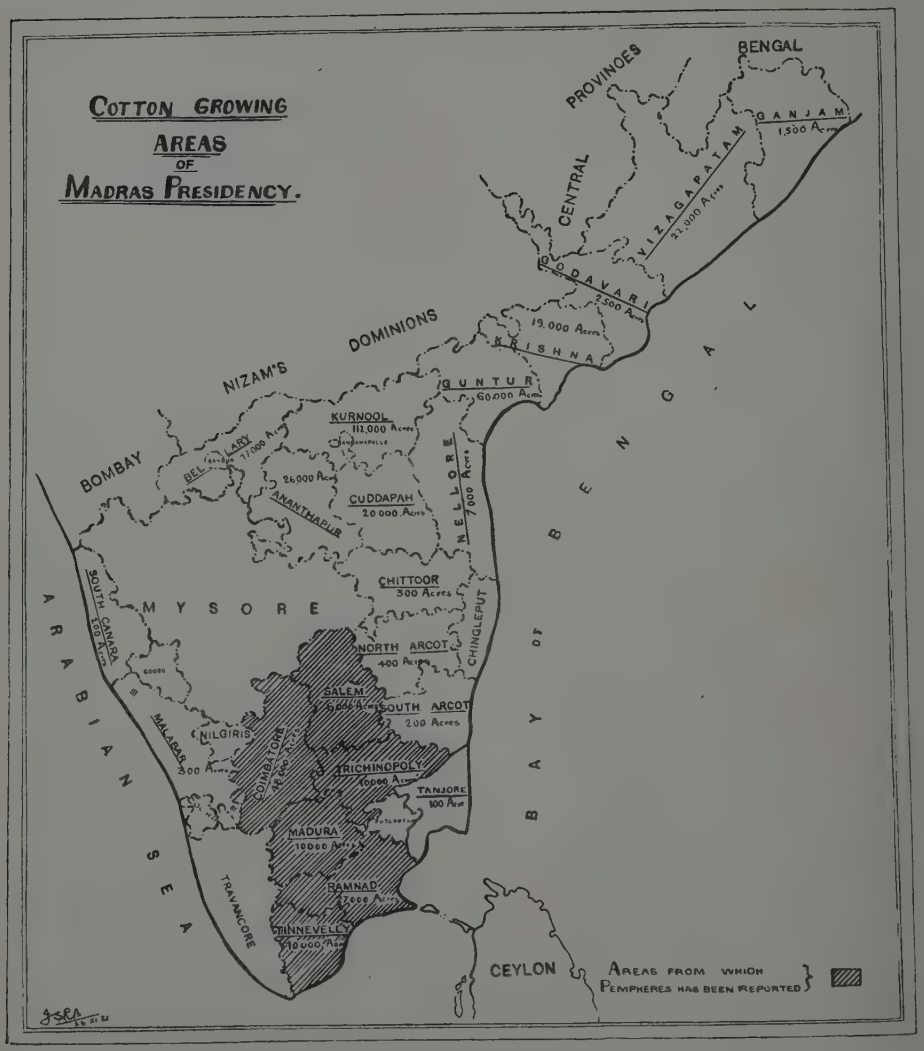
COTTON GROWING
AREAS
OF
MADRAS PRESIDENCY.
BENGAL
PROVINCES
CENTRAL
GANJAM
1,500 Acres
VIZAGAPATAM
22,000 Acres
GODAVARI
7,500 Acres
19,000 Acres
KRISHNA
DOMINIONS
NIZAM'S
GUNTUR
60,000 Acres
BOMBAY
KURNOOL
111,000 Acres
BELLARY
17,000 Acres
24,000 Acres
CUDDAPAH
20,000 Acres
ANANTHAPUR
NELLORE
7,000 Acres
CHITTOOR
300 Acres
MYSORE
SOUTH CANARA
1,500 Acres
NORTH ARCOT
400 Acres
CHINGLEPUT
SALEM
SOUTH ARCOT
200 Acres
NILGIRIS
MALABAR
300 Acres
COIMBATORE
TRICHINOPOLY
10000 Acres
TANJORE
100 Acres
MADURA
10000 Acres
RAMNAD
17000 Acres
TINNEVELLY
10000 Acres
TRAVANCORE
ARABIAN SEA
BAY OF BENGAL
CEYLON
AREAS FROM WHICH PEMPHERES HAS BEEN REPORTED

FURTHER NOTES* ON *PEMPHERES AFFINIS*, FST. (THE COTTON STEM WEEVIL).

BY

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Government Entomologist, Madras.

(Received for publication on the 3rd May, 1922.)

THE Cotton Stem Weevil has attained some notoriety in South India as a pest of exotic and indigenous cotton, and was at one time looked upon as the most serious enemy of the *raiyat* in the cotton-growing tracts.

Further experience goes to show that it is only in exceptional cases that it can be regarded as a pest of the first order, and it certainly cannot now be compared with such insects as *Platyedra gossypiella* or *Earias fabia* and *E. insulana*. In 1911-12, when *Pempheres* first came into prominence, it was undoubtedly a much more serious pest than it is now. It is probable that both Cambodia and indigenous cotton are becoming immune, or at least resistant to *Pempheres*.

The known distribution of *Pempheres* was until recently peculiar, as it was reported only from Pusa and Coimbatore. In another part of this paper are given the localities in South India in which it is now known to attack cotton, the exceptions being North and South Malabar where no cotton is grown. The question arises as to whether *Pempheres* has spread from some centre such as Coimbatore or if it is a matter of its having only within recent years taken to attacking cotton and, having once acquired a taste

* Many of the notes from which this paper is compiled were made by Messrs. P. V Isaac and T. V. Subramaniam.

for cotton from the exotic Cambodia cotton, has now spread to country varieties. Again, it might simply have been overlooked. As no stem weevil has been found in those localities where cotton growing has only recently been taken up, it is probable that *Pempheres* is only gradually acquiring the taste for cotton. *Pempheres* is by no means confined to cotton or even to Malvaceæ for its food-plants and has been found breeding in or feeding on many different plants. A pest with so many alternate food-plants, and one which is moreover a borer, is difficult to deal with, as it will always be able to carry over from one cotton crop to another. Cotton, too, is attacked at a very early age and *Pempheres* does not have to wait for bud or boll formation as is the case of *Platyedra*. It is not surprising then in the circumstances that the dead season decreed by the Pest Act between one cotton crop and another appears to have had little or no result in reducing the loss, such as it is, which is due to *Pempheres*, while in the case of *Platyedra* it has been so successful. According to laboratory results the adult weevil is long-lived (36 days) and this again would assist it to tide over a time when there is no cotton crop in the ground.

Remarks on the general habits of *Pempheres* are to be found in Lefroy's *Indian Insect Life*, Fletcher's *Some South Indian Insects* and in the *Madras Year Book* for 1918 (T. V. Ramakrishna Ayyar). This latter paper gives a general description of the different stages of the life-history and describes the nature of the damage done. In that paper it is stated that the stem weevil will reduce the normal out-turn of the cotton crop from 15-20 per cent. No figures are given in support of this statement, and, however accurate it may have been some years ago, it is certainly not the case now. Results obtained in 1920-21 by the Cotton Specialist at Coimbatore, and further observations in the field, make it extremely doubtful that anything approaching this amount of damage is done. There appears to be no difference in the yield from plants attacked by *Pempheres* and those which are free. In certain cases where plants lodge boll production is reduced, but these cases are the exception rather than the rule and an adult plant is rarely killed.* The chief loss is caused to seedlings which almost invariably succumb to stem weevil attack. There is some indication that certain strains of Cambodia are less liable to attack in their early stages than others, and among indigenous varieties *Karunganni* (*G. indicum*) is much less affected than *Uppam* (*G. herbaceum*).

* For an exception to this rule is the report from Messrs. Harvey in another part of this paper.

PEMPHERES AFFINIS.

The Bourbon-Cambodia cross is not so readily attacked as Cambodia. Work along the lines of finding a *Pempheres*-resistant strain is only in its infancy and is still in progress, but the results obtained in 1920-21 which are to be given in another paper show that there are distinct possibilities in this direction. Whether such resistance or unattractiveness can be combined with other desirable qualities in Cambodia cotton remains to be seen.

The present paper embodies some further facts in the [illegible] (Plate XXIII) of *Pempheres affinis* and the results obtained in [illegible] the study of the different degrees of infestation in the Cotton Specialist's selections at Coimbatore. The present distribution of *Pempheres* as far as it is known is shown in the map which forms the frontispiece (Plate XXI). Further inquiries will probably add greatly to the [illegible] now shown.

EXPLANATION OF PLATE XXIII.

Pempheres affinis.

Life-history.

Fig. 1. Cotton plant showing swellings on the stem caused by the grub boring inside, and also an egg laid just under the bark.

" 2. Egg shown separately with thin layer of the bark removed, magnified.

" 3. The weevil grub .. × 10.

" 4. The pupa " .. × 12.

" 5. Pupa " " × 14.

" 6. The adult weevil, dorsal view × 14.

" 7. Adult " " side view × 14.

" 8. An infested stem cut open to show grubs and pupæ inside.

In the paper on *Pempheres affinis* [illegible] following are given as the average periods [illegible] history :—

Further investigation has shown (under laboratory conditions) that [illegible] the egg period remains constant at from 6–8 days, [illegible] the time of the year, the length of the larval life is variable [illegible] 35–57 days. The pupal period is from 9–10 days. After [illegible] development the adult remains from 2–5 days in the pupa. Adults have lived in the Insectary for 36 days. They may live longer [illegible] *Pempheres* is very free from natural enemies but a Chalcid has been reared which parasitizes the larva, and a fungus has been found which destroys all stages except the egg. Work on this is not yet complete but it would appear to be a much more effectual control than the Chalcid.

Differentiation of male and female.

In the original description of *Pempheres affinis* no differentiation between [illegible] are given for the males and females. In the paper on the stem weevil (*Agric. Year Book*, 1919), it is mentioned that there are a pair of spines [illegible] coxal cavity of the forelegs. These spines do not exist in the female and

EXPLANATION OF PLATE XXIII.

Pempheres quadrata.

Fig. 1. Cotton plant showing swellings on the stem caused by the grub boring inside, and also an egg laid just under the bark.

" 2. Egg shown separately with skin layer of the bark removed, magnified.

" 3. The weevil grub . . × 10.

" 4. The pupa . . × 12.

" 5. The adult weevil, dorsal view × 14.

" " side view × 14.

" 6. An infested stem cut open to show grubs and pupæ inside.

The Bourbon-Cambodia cross is not so readily attacked as Cambodia. Work along the lines of finding a *Pempheres*-resistant strain is only in its infancy and is still in progress, but the results obtained in 1920-21 which are to be given in another paper show that there are distinct possibilities in this direction. Whether such resistance or unattractiveness can be combined with other desirable qualities in Cambodia cotton remains to be seen.

The present paper embodies some further facts in the life-history (Plate XXIII) of *Pempheres affinis* and the results obtained in 1920-21 from the study of the different degrees of infestation in the Cotton Specialist's selections at Coimbatore. The present distribution of *Pempheres* as far as it is known is shown in the map which forms the frontispiece (Plate XXII). Further inquiries will probably add greatly to the area of distribution now shown.

Life-history notes.

In the paper on *Pempheres affinis* in the *Madras Year Book* 1918, the following are given as the average periods for the different stages of the life-history :—

Egg	10 days.
Larva	35 ,,
Pupa	12 ,,
Adult	30 ,,

Further investigation has shown (under laboratory conditions) that, although the egg period remains constant at from 6–8 days, depending perhaps on the time of the year, the length of the larval life is variable and lasts from 35–57 days. The pupal period is from 9-10 days. After completing its development the adult remains from 2–5 days in the stem. Adults have lived in the Insectary for 36 days. They may live longer than this in nature. *Pempheres* is very free from natural enemies, but a Chalcid has been reared which parasitizes the larva, and a fungus has been found which destroys all stages except the egg. Work on this is not yet complete but it would appear to be a much more effectual control than the Chalcid.

Differentiation of male and female.

In the original description of *Pempheres affinis* no differentiating characters are given for the males and females. In the paper on the stem weevil (*Madras Year Book*, 1919), it is mentioned that there are a pair of spines above the coxal cavity of the forelegs. These spines do not exist in the female and

are represented only by tubercles; it is only in the males that the spines are developed (Fig. 1). Judging from observation of beetles in the laboratory, the female is much less active than the male who runs continually over the food-plants while the female does not move about nearly so much. During copulation the male grasps the female with the middle pair of legs

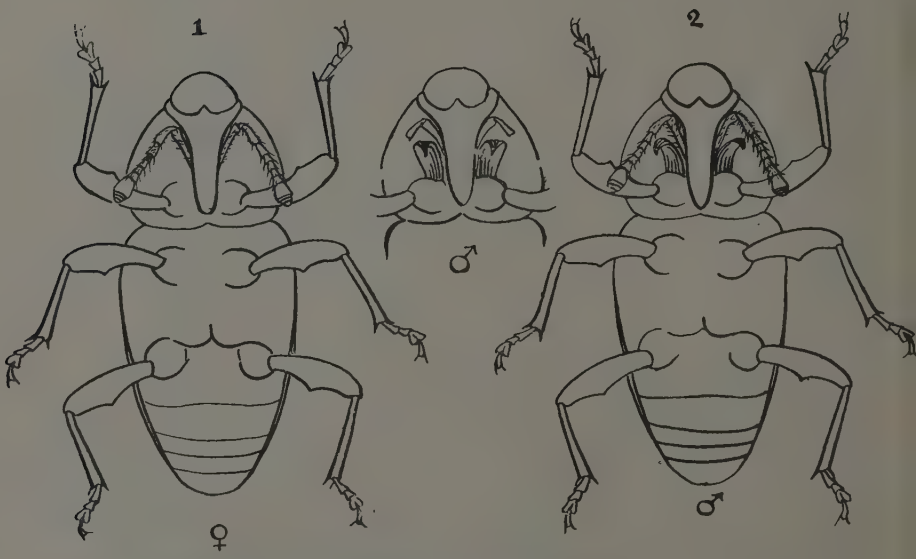

FIG. 1. Ventral aspect of male and female of *Pempheres affinis* and the coxal spines of the male.

and continually strokes her head and antennæ with his forelegs and antennæ. Sometimes this stroking process becomes a violent tattoo. The female also at times strokes her head with her forelegs, or rubs the tarsi together, the forelegs being held out in front. In the case of one pair which was under observation, the male ceased his stroking and the female after two or three minutes became restive but was immediately calmed down again on the male renewing his attention. Copulation lasts as a rule about five minutes.

TABLE I.

Egg period.

Date of laying	Date of hatching	Length of period in days
18-19- VI-19	25-26- VI-19	7
19-20- VI-19	27-28- VI-19	8
27- VI-19	4-VII-19	7
28-29- VI-19	5-6-VII-19	7
28-29- VI-19	6-7-VII-19	8
9-10- VI-19	16-17-VII-19	7
11-12-VII-19	18-VII-19	7
15-VII-19	23-VII-19	8
17-VII-19	23-VII-19	7
17-VII-19	24-VII-19	6
18-VII-19	25-VII-19	8
18-VII-19	26-VII-19	..
18-VII-19	26-VII-19	6
19-VII-19	26-VII-19	7
19-VII-19	26-VII-19	7
19-VII-19	26-VII-19	8
14-VII-19	20-VII-19	7
20-VII-19	27-VII-19	7
21-VII-19	29-VII-19	7
21-VII-19	29-VII-19	6
22-VII-19	29-VII-19	7
22-VII-19	30-VII-19	8
23-VII-19	31-VII-19	8
23-VII-19	31-VII-19	8
24-VII-19	31-VII-19	7
25-VII-19	31-VII-19	6
26-VII-19	2-VIII-19	6
27-VII-19	5-6-VIII-19	8-9
28-VII-19	6-VIII-19	9
28-VII-19	3-VIII-19	6
28-VII-19	3-VIII-19	6
28-VII-19	6-VIII-19	9
29-VII-19	6-VIII-19	8
29-VII-19	6-VIII-19	8
8-9-VIII-19	17-VIII-19	8
12-VIII-19	20-VIII-19	8
15-VIII-19	23-VIII-19	8
15-16-VIII-19	21-22-VIII-19	6
8-9-VIII-17	17-VIII-17	9

This gives an average of just over seven days from the time the egg is laid until the time of hatching.

LENGTH OF LARVAL LIFE.

The period occupied by the larval stage varies considerably as the accompanying Table II shows. This may be natural or may be due to laboratory conditions. To facilitate observation, larvæ were kept in pieces of cotton stem or stem of another food-plant (but generally cotton) and these stems placed in culture solution to keep them fresh. Grubs had often to be transferred

from one piece of stem to another, and were often looked at to ascertain the exact time of pupation. All this might upset the normal course of the larval existence. It is difficult in the case of borers to be certain that the environment in which they are kept is an exact enough reproduction of natural conditions.

TABLE II.

Length of larval life.

Date of hatching	Date of pupation	Length of period in days
5-6–VII–19	21–VIII–19	41
5-6–VII–19	26–VIII–19	51
6-7–VII–19	17–VIII–19	31
6-7–VII–19	19–VIII–19	33
6-7–VII–19	31–VIII–19	54
6-7–VII–19	2–IX–19	56
23–VII–19	29–VIII–19	37
23–VII–19	27–VIII–19	36
23–VII–19	2–IX–19	40
26–VII–19	27–VIII–19	32
26–VII–19	9–IX–19	44
27–VII–19	28–VIII–19	31
27–VII–19	4–IX–19	Doubtful when actually became pupa.
29–VII–19	2–IX–19	36
29–VII–19	2–IX–19	36
31–VII–19	2–IX–19	Pupation probably on 1–IX–19.
31–VII–19	9–IX–19	40
31–VII–19	13–IX–19	44
6–VIII–19	22–IX–19	47
6–VIII–19	22–IX–19	47
13–VIII–19	22–IX–19	40
5-6–VIII–17	6–IX–17	32
5-6–VIII–17	10–IX–17	36
5-6–VIII–17	6–IX–17	32
17–VIII–17	11–X–17	55
1-2–VIII–19	9–IX–19	38
1-2–VIII–19	30–IX–19	59
31–VII–19—2–VIII–19	9–IX–19	38-40
27-28–VI–19	21–VIII–19	54
28-29–VI–19	17–VIII–19	50
28-29–VI–19	19–VIII–19	52

This table gives an average of about 42 days from time of hatching to time of pupation.

PUPATION.

This takes place in a chamber prepared by the larva which is generally deep in the stem. Before pupation the larva usually cuts a passage for the adult weevil to the exterior, leaving only the bark to be nibbled through when the beetle finally emerges. The beetle usually stays 2–5 days in the pupal chamber before coming out.

TABLE III.

Pupal period.

Date of pupation	Date of becoming adult	Length of period in days
(?)16–VII–20	22–VII–20	6
19–VII–20	28–VII–20	9
9–X–18	19-20–IX–18	10
10–IX–17	20–IX–19	10
6–IX–17	15–IX–17	9
13–IX–19	22–IX–17	9
30–IX–19	9-10–X–17	9-10
11–X–17	22–X–17	11
14–X–17	24–X–17	10

An average of 9-10 days.

Pairing generally takes place a day or two after emergence from the attacked plant and egg-laying begins two or three days afterwards. Pairing occurs more than once.

Attempts to obtain egg-laying records have not been attended with much success. A maximum of 30 from one pair is recorded, but, judging from the rapid rate of increase in the field and the large number of larvæ sometimes found in one stem, it is quite possible that far more than 30 are laid in nature by one female.

EGG-LAYING RECORDS.

Freshly emerged male and female.

Caged	25–VII–19	first egg laid	26–VII–19	♀	lived	17	days	laid	19	eggs
Emerged	18–VI–19									
paired	19–VI–19 and	„	26–VI–19	♀	„	21	„	„	20	„
again on	23–VI–19	„	26–VI–19	♀	„	12	„	„	17	„
Brood of	29–VI–19									
Pair (1)	Found in cop. 30–VI–19	„	2–VII–19	♀	„	15	„	„	3	„
(2)	.. ..	..	..	♀	„	10	„	„	11	„
(3)	.. ..	..	..	♀	„	9	„	„	11	„
(4)	.. ..	..	..	♀	„	10	„	„	15	„

First egg laid 3 days after emergence and two days after coupling.

29–VI–19 freshly emerged ♀ and two ♂ ♂

Paired	2–VII–19	First egg laid	5–VII–19	♀	lived	29	days	laid	20 eggs.
♀ of	10–VII–19	„	14–VII–19	♀	„	20	„	„	22 „
♀ of	11–VII–19	„	12–VII–19	♀	„	14	„	„	6 „
♀ of	11–VII–19	.. ..	..	♀	„	22	„	„	30 „
♀ of	12–VII–19	.. ..	..	♀	„	21	„	„	12 „

The length of life from egg to adult.

	Date of laying	Date of death	Length of period in days
(1)	8-9–VII–17	6–XI–17	87
(2)	8-9–VII–17	18–XI–17	99
(3)	27–VII–17	12–X–17	77
(4)	27–VII–17	24–X–17	89

It will be seen at least two of these individuals would have been able to survive the dead season for cotton which lasts from 1st August to October or the beginning of November depending on whether the north-east monsoon bursts late or early. The average life from egg to time when adult is ready to lay would be just over two months.

By examining a certain number of stems weekly and noting the proportion of larvæ to pupæ contained in them it was hoped that an indication would be given of the number of broods in the year, supposing that any definite broods existed. Plate XXIV, fig. 1, shows results obtained in 1919-20 and is self-explanatory.

Plate XXIV, fig. 2 shows the same thing for 1920-21 except that in this case the matter is gone into in greater detail and larvæ found were grouped under three headings :—those under 2 mm., those between 2 and 5, and those over 5 mm. It will be seen that there was a high proportion of freshly hatched larvæ (*i.e.*, under 2 mm.) in February, April, the middle of May and first half of June. Examination of stems pulled up after the season (*i.e.*, after 1st August) also showed a high proportion of young larvæ (not shown in graph).

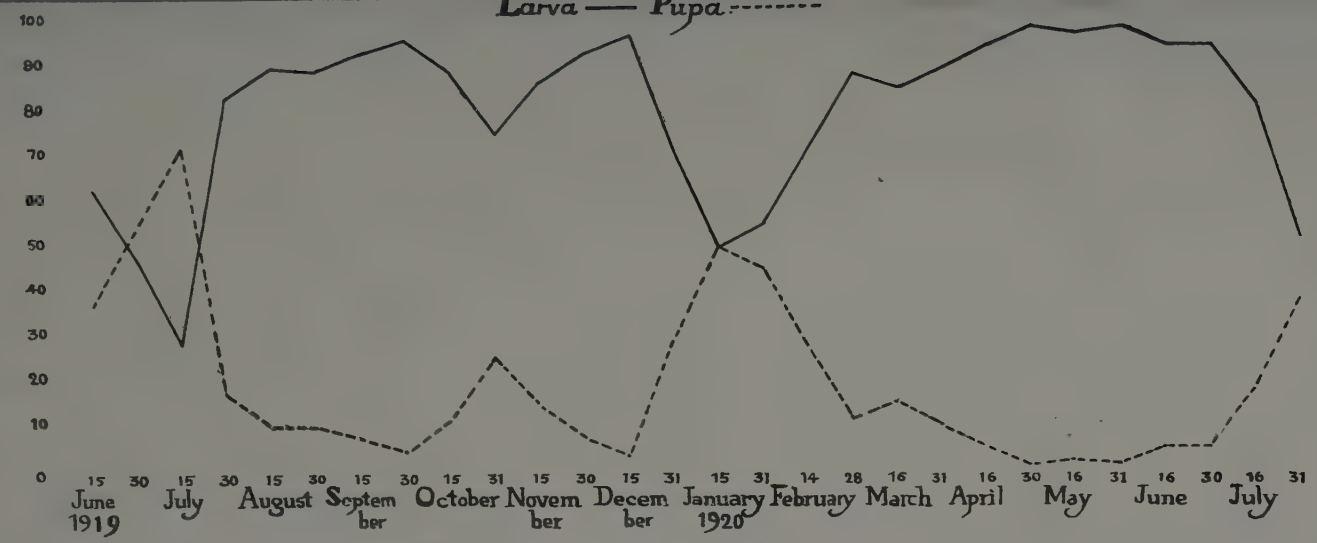
Larva —— Pupa ------
100
90
80
70
60
50
40
30
20
10
0
15 30 15 30 15 30 15 30 15 31 15 30 15 31 15 31 14 28 16 31 16 30 16 31 16 30 16 31
June 1919
July
August
September
October
November
December
January 1920
February
March
April
May
June
July

Fig. 1.

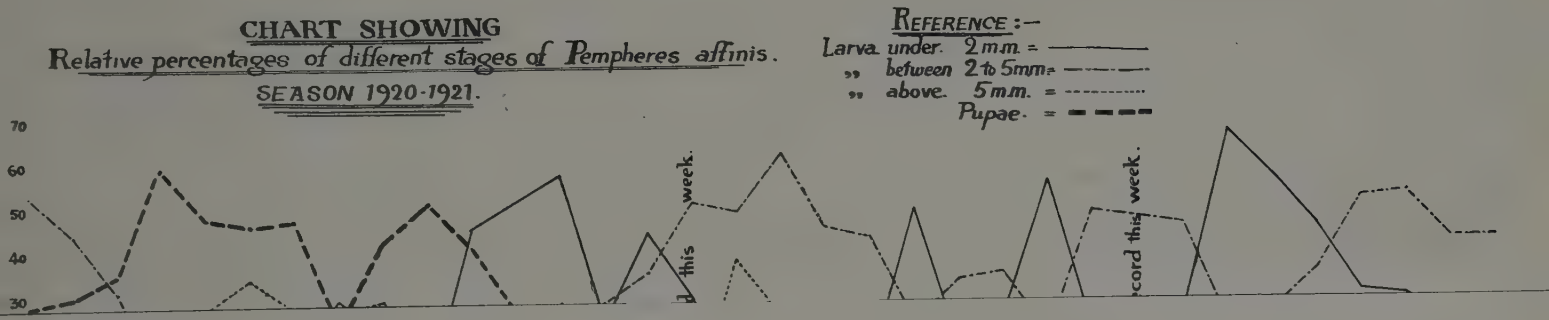
CHART SHOWING
Relative percentages of different stages of Pempheres affinis.
SEASON 1920-1921.
REFERENCE :-
Larva under. 2 m.m. =
" between 2 to 5mm =
" above. 5 m.m. =
Pupae. =
70
60
50
40
30
this week.
cord this week.

Degree of infestation of plants in the field.

Once any field is attacked the number of infected plants increases rapidly throughout the season and infestations of 90 per cent. are common by the end of July.

Table IV.

	Date of examination	Percentage of attack
Field No. 39, Central Farm. Sown October (?), 550 plants in one row	25-XI-19—10-XII-19	10·5
	16-VII-20	92·3
Field No. 23. Sown 25-IX-19	14-XI-19	10·8
Field No. 19B, 403 plants. Sown 6-X-19 ..	25-XI 19—10-XII-19	10·6
	16-VII-20	94·0
Field No. 15 A & B. Sown Oct. ? 579 plants ..	25-XI-19—10-XII-19	10·7
	16-VII-20	88·5
Field No. 54, 1,062 plants. Sown 29-IX-19 ..	25-XI-19—10-XII-19	15·8
	16-VII-20	88·5
Field No. 20, 866 plants. Sown 30-IX-19 ..	25-XII-19	8·02
	14-VII-20	90·3

Plants are attacked three weeks after germination and are then almost invariably killed. It is while the crop is in the seedling stage that most damage is done.

Pempheres attack at Virudupatti in 1921.

In April 1921, a report was received from the Agent for Messrs. Harvey, at Virudupatti in Tinnevelly District, that a new pest was playing havoc with the cotton in that district. Investigation showed that the pest in question was the stem weevil. The centre of infection appeared to be Virudupatti town. Examination of plants taken at random showed that the infestation was 65–75 per cent. on the north and east of the town and gradually decreased to 4 per cent. and 2 per cent. in fields further away. The result of examination of a number of plants is given in

the diagram attached (Fig. 2). It will be seen that the infested area was not large and that infection appears to spread from a definite

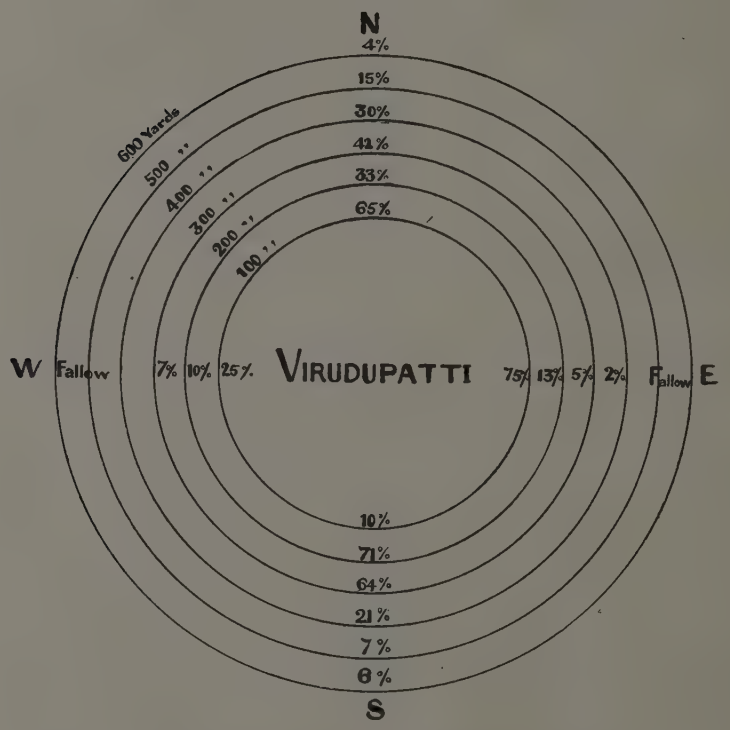

FIG. 2. DIAGRAM SHOWING PERCENTAGES OF PEMPHERES INFESTATION 1921 ROUND ABOUT VIRUDUPATTI.

centre. The mortality was high, 29 per cent. of 200 attacked *Uppam* plants being killed. Curiously enough, Cambodia in the same area, while showing a higher percentage of attack (69 per cent.), showed a smaller percentage of deaths (11·5 per cent.). It was observed that the *Uppam* plants had not produced bolls whereas the Cambodia had done so.

Powers of survival in dry stems.

Infested cotton plants pulled up and kept in the laboratory continued to produce beetles for some time. One interesting point was that, as the stems dried up, the weevils which emerged became smaller and smaller. A pair of these dwarf weevils was mated and the offspring successfully reared. Owing to an oversight the parents were put into the general collection unmarked so that their exact measurements could not be made, but the result of their union was larger than its parents. These observations tend to show that when at the end of the season cotton plants are pulled up and stacked in or near cotton fields although they are drying up, weevils will emerge from them for some time afterwards and help to carry on the race until the next crop is in a fit state to be infested. It would however seem that, if cotton stems are dried in the sun before being stacked, grubs are not able to complete their development. This way of killing off grubs and beetles at the end of the season is of course dependent on sunny days, whereas in July and August when plants should be pulled up there are frequent showers and the days are often cloudy.

Cotton plants pulled out on 29th July, 1920, and kept in a cage in the Insectary continued to produce weevils up to 13th September, 1920.

From another lot beetles continued to emerge for one month, *i.e.*, up to 30th August, 1920.

From another lot pulled up in the hot weather, 20th to 30th May, 1919, dwarf weevils emerged on 29th June, 1919, normal weevils came out at intervals, up to 13th July, 1919, when another dwarf was found. One more dwarf came out on 21st July, 1919, after which date no more emerged.

On 25th June, 1917, infested plants were brought into the Insectary. Weevils continued to come out from them up to 28th August, 1917.

Plants pulled up on 29th July, 1919, and kept in the sun produced no weevils. From another lot of 100 stems dried in the sun for ten days no weevils emerged.

Food-plants other than cotton.

It has already been stated that *Pempheres* has many other food-plants than cotton. A list of these is given below. *Pempheres* has been bred from all of them with the exception of those marked*, from which only adults have

Fig. 1. Uppam plants infected with *Pempheres* but not lodged.

Fig. 2. Patches due to lodging of Cambodia plants.

Fig. 3. Cambodia plant killed by *Pempheres*.

resistant than Cambodia, in which plot there are many gaps. The degree of infestation was the same. It might be noted in passing that the proportion of Cambodia plants which lodged was very high compared with the amount observed in the field (Plate XXV).

As regards the attractiveness or otherwise of different strains of Cambodia the following results from counts made on Government seed farms and in the fields of neighbouring *raiyats* are not without significance. The seed farms belong to *raiyats* but the seed is supplied by the Government. The other *raiyats'* fields were sown with seed obtained from dealers. These results may simply be connected with the frequently observed fact that a healthy strong crop is much less liable to be damaged by insects than one which is weakly. There is a very wide field for study in what exactly constitutes healthiness or otherwise in plants and what physiological changes take place which attract insect pests to them or enable them to multiply. Until a chemist can be found to work on this subject it must to a large extent remain a mystery. The future of the control of many pests is, however, largely bound up with this problem, which will involve both chemical and botanical research. There appears to be no reason why insect-resistant crops should not be evolved in the same way as fungus-resisting wheat and cane are now being grown.

	Date of examination	Percentage of attack
I. Seed Farm. Coimbatore District ..	9-11-IV-21	7·5
II. „ „ „ ..	9-11-IV-21	7·0
III. „ „ „ ..	9-11-IV-21	7·5
IV. „ „ „ ..	9-11-IV-21	6·5
Raiyats' field adjoining I	....	17·5
„ „ same area	....	22·0

AN ACCOUNT OF EXPERIMENTS ON THE CONTROL OF *SIGA (SCHŒNOBIUS) INCERTELLUS* IN THE GODAVARI DELTA

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I. Introduction.

Of all the pests from which paddy suffers, the paddy stem borer *Schœnobius incertellus* (*bipunctifer*) is the most persistent. Although *Spodoptera mauritia* does more damage when it appears, it is much more sporadic in its habits and is generally limited to one time of the year. *S. incertellus*, on the other hand, is always to be found wherever paddy is grown in the East and it has been estimated that it causes an annual loss of 10 per cent. of the entire Indian paddy crop. The amount of damage to particular fields and districts has been estimated at as much as 60 per cent., but estimates not based on a number of counts must be regarded with caution. The characteristic white and dead ear-heads which are the signs of the presence of *Schœnobius* in the crop catch the eye, and a field which is perhaps only 3–4 per cent. attacked appears to be very much worse than it really is. The life-history cycle is too well known to need more than a passing mention here. Suffice it to say that eggs are laid in masses covered with hair on the leaves of the paddy plants. From these the young larvæ on hatching distribute themselves and bore into the developing stems. Pupation takes place in the stem. The length of life cycle is about 5 weeks.

Various schemes have been put forward for controlling *Schœnobius*, of which that most often advocated is the use of light traps. The writer is very doubtful about the efficacy of these traps. They are expensive. They are liable to be stolen. Moths are not attracted to them on moonlight nights and moreover a certain proportion of the moths have laid their eggs before they

are caught. Others again are only attracted towards the light and rest near it and lay their eggs on the surrounding paddy. At certain seasons of the year it is a pure waste of money to keep light traps burning as practically no moths are flying. What these periods are has not been worked out yet for any except part of the Godavari Delta and those dates require confirmation. It is a matter of first importance when dealing with control measures for insect pests in such a country as India, where capital is scarce, to try and adapt some local agricultural practice to one's needs. In this way the conservatism of the *raiyat* is not shocked and existing habits need not be disturbed. More important than anything else, any control must be cheap. The methods of control of the paddy stem borer put forward in this paper are the result of an attempt to fulfil the above conditions in the Godavari Delta. It is very improbable that they could be used in other paddy growing tracts in the Presidency, such as Malabar, for example, where there is not much transplanted paddy and in the Southern parts of which district *Schœnobius* is reported to be a very serious pest. The suggestions put forward here apply then only to the Delta area where the paddy is all transplanted and single seedling transplantation is the rule.

Paddy crop in the Delta. Two crops of paddy are raised annually in the Delta. They are known as the *Sarva* and the *Dalwa* crops. The *Sarva* is the long crop and lasts from July to December or early January; the *Dalwa* from January to May. The time of transplanting depends on the receipt of water from the Godavari canals and takes place in July and January–February. A certain amount of short duration paddy is grown for the *Sarva* crop. The *Dalwa* is always a short crop. Certain tracts cannot get water for the *Dalwa* season, in which case dry crops of pulses, etc., are grown. *Dhaïncha* is usually sown in the standing paddy and ploughed in as manure for the succeeding crop. There is an interval between the *Dalwa* or second crop and the first crop, but between first and second crops there is no interval, the seed beds for the second crop being prepared before the harvest of the first. There is therefore a continuous food-supply for the stem borer from June to July of one year to May of the next. From May to July the fields are dry but there is always some water standing during the rest of the year and there is often a ratoon crop springing from the stubble between one harvest and the next transplanting. The whole Delta is flat and very little above sea-level. Irrigation is from canals which are fed by the Godavari river. The chief rainfall is from the North-east monsoon which breaks in October–November. There is some rain in July from the South-west monsoon which may be of assistance in preparing the seed beds for the *Sarva* crop.

In 1918-1919 numerous complaints had been received from the Collector of Kistna District and from *raiyats* about the large amount of damage done by *Schœnobius* and *Spodoptera*. A campaign was arranged to demonstrate the use of light traps for *Schœnobius* and flooding and so on for *Spodoptera*. This had to be abandoned owing to lack of staff. Later, after a motion in the Legislative Council that a grant of Rs. 10,000 should be made towards the cost of a demonstration amongst the *raiyats* in the Delta, another campaign had hurriedly to be arranged. This was limited to *Spodoptera* control but at the same time a site was looked for where work on *Schœnobius* could be carried on on a large scale which could act at once as an experiment and a demonstration. There was some difficulty in finding the necessary staff for the work as the whole activities of the Entomological Section were engaged by cotton. In the end and after some time had been wasted owing to illness and subsequent resignation of one of the staff selected, work began in earnest in 1920.

The site selected for the work was at Podalada village in Tanuku *Taluq* in the Godavari Delta (Kistna District). A *raiyat* there who owned about 120 acres of land very kindly put it at the disposal of the Agricultural Department on the understanding that he should be indemnified in the case of loss and that the Department should pay all extra cultivation expenses. The Department was able to get water for three successive crops, that is, *Dalwa* and *Sarva* 1920 and *Dalwa* 1921. The records for *Dalwa* crop 1920 are in many ways incomplete for the reasons given above, and although losses of 60 per cent. have been reported from this area it was found that the general percentage of attack was so low that it gave no fair test of the control methods which were being tried ; in fact, it was doubtful whether any controls were necessary. Some good was done by interesting the local *raiyats* who used to come and see all that was going on, and the existence of the Department was advertised. This alone was a good thing, for the Delta areas are a great centre of the non-co-operation movement and a demonstration to the effect that Government gives as well as takes is bound to work for good.

In June 1921 the Government Farm at Samalkota, Godavari District, was selected as the most suitable site for carrying on the experiments as the writer knew from personal experience that *Schœnobius* was a serious pest there. Moreover it is a much more accessible place than the Western Delta and consequently more direct control could be exercised over any work which was in progress. A Sub-station has now been established there and experiments started with the present (1921) *Sarva* crop. As the station in Tanuku *Taluq*

has now been closed down, the present paper has been compiled showing the results obtained during the 18 months in which work was carried on there.

II. Programme of work.

(1) To ascertain the amount of damage done to each crop by *Schœnobius*.
(2) To compare damage done in the experimental area with that in the surrounding fields.
(3) To obtain a record of the dates when the moths were flying.
(4) The time of the night when moths were most active.
(5) To keep a profit and loss account so as to compare the amount of crop saved, if any, with the expenses of saving it.
(6) Search for alternative food plants.
(7) Natural enemies.
(8) To find where the insect passes the " off " season.
(9) Possibility of burning stubble after harvest or of grazing it off with cattle, with a view to destroying pupæ or larvæ left in it.
(10) Close cutting of the crop at harvest time.
(11) To find whether or no *Schœnobius* prefers one variety of paddy more than another.

The following was the scheme of work which was carried on at Podalada :—

(1) As soon as transplanting was begun boys were employed who had been taught to recognize dead hearts in the seedlings. As the seedlings were pulled up from the seed beds and bundled for being carried to the fields for transplantation, each bundle containing 300–400 seedlings was handed over to one of the boys who examined it for signs of *Schœnobius* attack and for egg-masses. All damaged seedlings were rejected and the bundles retied. The rejected seedlings were destroyed. Egg-masses and larvæ from eggs laid while the crop was in the seed-bed were thus got rid of. The chances of the crop being damaged while the ear-heads were being formed, which is the time when most damage is done, should by these means be lessened to such a degree that the loss due to *Schœnobius* would be negligible. When working the *Dalwa* crop of 1921 a large number of fresh egg-masses was found at the time of transplanting, the total being 14,033, which would mean the destruction of some 2,806,600 potential moths. In combination with seedling selection, and with the idea of destroying as many pupæ and larvæ as possible which might be

left in the stubble after harvest, close cutting of the crop was advocated. The idea of burning the stubble which had been put down as part of the programme was not found to be practicable, but will probably be tried again.

(2) A light trap, consisting of one hurricane lamp hanging over a tray containing water and kerosene was kept burning throughout the year. The number of moths caught gave an indication of emergence of fresh broods. The daily catch, when there was one, was divided into moths which had not laid eggs, spent moths, and males. The trap was situated outside the experimental area so as to keep it from interfering in any way with the control measures in operation in the experimental area.

(3) Before harvest, when it was possible to distinguish damaged earheads or dead hearts, plots ten square yards each were taken on the lines of two diagonals across the experimental area and the percentage of dead hearts in each was calculated. These added together gave the average for the whole area. Similar counts were made in surrounding fields to give an idea of the attack in non-treated areas.

The area chosen for the experiments was a compact block of some 120 acres (Fig. I) of which about 100 acres were cultivated. It is quite possible that some infection took place from surrounding fields, but on the whole the experimental area was big enough to give a sufficiently accurate idea as to the efficacy or otherwise of our methods.

The business of seedling selection is very simple and should be no more difficult to teach the *raiyats* than that of single seedling transplantation which has been so successfully propagated by the Department in the Southern districts of the Presidency. If no better results were obtained than that of reducing the loss from 10 per cent. to 5 per cent. throughout the Delta the labour involved would be worth while and the saving in money would be great. The results given hereafter are from only 18 months' work and in all probability a series of observations spread over a number of years will be required before any definite statement can be made as to the complete success of seedling selection as a control. The most that can be said at present is that it is promising and it is hoped that the work at Samalkota will confirm what was done at Podalada.

It may be noted in passing that young boys are the best to employ for examining seedling bundles. They are quick at their work, take an interest in it and are much more intelligent than adults, either men or women.

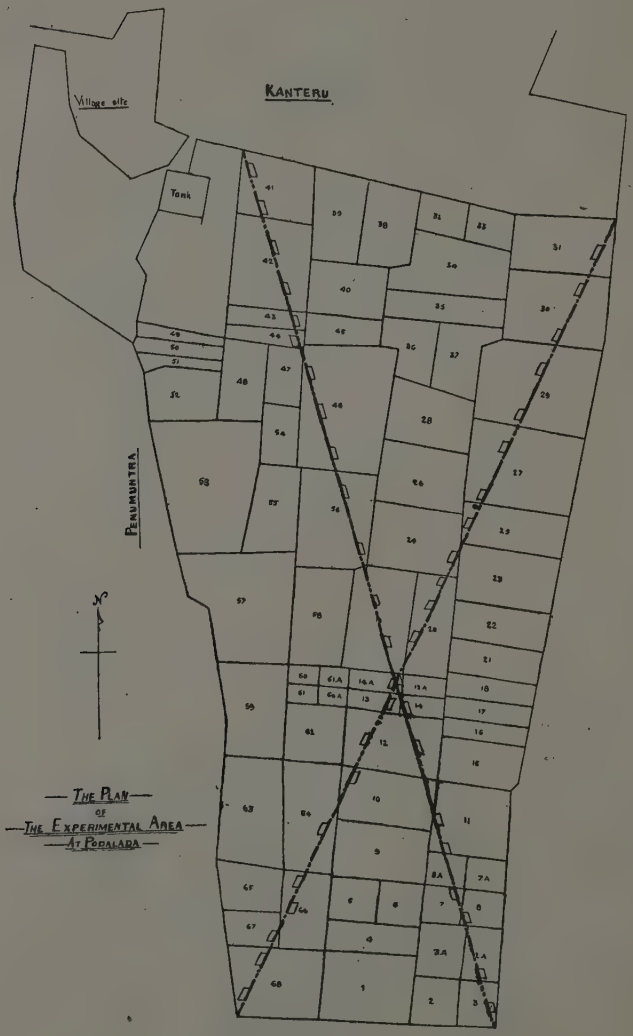

FIG. I.

III. Infestation, May 1920—May 1921.

Work began at Podalada as stated above with the *Dalwa* crop of 1920. The figures for the percentage of affected seedlings are not

available and those for the emergence of moths very incomplete. It was possible, however, to make counts of the degree of attack in the experimental and non-experimental areas before harvest; the figures for which are given in the accompanying table.

TABLE I.

EXPERIMENTAL AREA		NON-EXPERIMENTAL AREA	
No. of plots	Per cent. dead ear-heads	No. of plots	Per cent. dead ear-heads
1	1·8	1	4·1
2	5·9	2	3·6
3	1·7	3	1·3
4	4·9	4	2·2
5	5·6	5	11·1
6	4·0	6	5·6
7	4·0	7	5·2
8	8·4	8	5·2
9	6·8	9	3·4
10	6·9	10	4·3
11	0·7	11	5·5
12	5·1	12	4·0
13	5·4	13	3·5
14	4·8	14	7·3
15	5·5	15	7·3
16	7·3	16	9·0
17	0·6	17	4·9
18	0·5	18	3·6
19	6·6	19	6·4
20	5·0	20	5·0

This shows an average for the experimental area 4·56 per cent. and for the non-experimental area 5·12 per cent. or a difference of about 0·6 per cent., that is to say, practically no difference at all. As, however, only 20 counts were taken in each area, I do not attach very much value to these figures.

This may have been due to the fact that the boys had to be trained and to the unsatisfactory work of the assistant who resigned. The planting of the *Sarva* crop began on 17th June 1920 and continued for five weeks, till the 27th July. The total number of dead-hearts picked out was 15,571.

TABLE II.

Average percentage of dead-hearts during week.

30-VI-20	0·075
10-VII-20	0·065
17-VII-20	0·060
24-VII-20	0·030
27-VII-20	0·020

Average 0·052 per cent. ; this is equal to about 145 seedlings an acre.

Shortly before harvest counts were made on 39 plots of 10 square yards each in the experimental area and 20 in the non-experimental area for the short duration variety, *Garikasanna vari*, and in 10 plots for the *Krishnakatukulu* or long duration variety, in each area. The average percentage of dead-hearts for the experimental area for the short crop was 0·9 per cent. and in the non-experimental area 1·25 per cent. This short crop is always very much less liable to attack than the long duration crop. For the *Krishnakatukulu* crop the counts gave 2·64 per cent. and 4·52 per cent. for the experimental and non-experimental areas respectively. The cost of the whole operation came to approximately 8 annas an acre. This would represent only a profit of a few rupees on 100 acres in view of the fact that the general loss from *Schœnobius* was so low.

Dalwa crop, 1921.

Planting began on 24th January and was finished by the 5th February. This was the crop from which while seedling selection was in progress numbers of egg-masses were found and destroyed.

Number of dead-hearts found	11,689
Average for the season of transplanting	0·042 p.c.

The total number of egg-masses collected came to 14,033.

As plenty of labour was available transplanting was rushed through quickly. This crop was harvested in May 1921. 50 plots were counted in the experimental area, and 50 in the outside fields. These gave the following figures :—

	Per cent
For the experimental area attack	0·51
For the non-experimental area	1·91

With infestation as low as this, control measures are unnecessary, nor is it possible to get an accurate idea as to whether the controls are being effectual. There is a decided difference between experimental area and non-experimental area of *Sarva* 1920 and *Dalwa* 1921, but so small is the attack in the whole neighbourhood that it is very doubtful whether the process was worth the few rupees gained by it. The cost of the work for this crop was about 6 annas an acre.

IV. Number of broods in the year.

During latter part of May 1920 the catches of moths were insignificant and lights could often not be put out owing to rain or wind. But at one light, set up on 12th—15th May, the figures were as follows :—

Males	Females gravid	Females spent	Percentage of spent
177	845	339	28·6

It will be seen that, as in 1921, there was a big brood in May.

The catches made in the light traps are recorded in Figs. II and III, Fig. II representing the season 1st May—31st December 1920, and Fig. III the *Dalwa* crop 1921 January 1st—May 31st.

Below the curves are shown in diagrammatic form the hours of moonlight throughout the year. The nights with bright moonlight between 6 p.m. and 11 p.m. are the general cause of the gaps in the curve between October and March. The biggest broods were in May 1920 and February 1921. To all intents and purposes there is a continuous emergence of moths, or moths are flying, from 1st October to the middle of March, there is then a short interval, and another big brood emerges in May. After this month very few moths are flying until the beginning of October. Figures obtained this year at Samalkota (June-October) *corroborate those from Podalada.** And a short duration variety on the Government Farm which was just ready for harvest early in September (1921) showed not a single case of *Schœnobius* attack. In Figs. II and III it will be seen that a very small proportion of males came to light.

Moths which emerge in December and January would infect the seedlings for the *Dalwa* crop, and it is hoped that by seedling selection during transplantation the March and April broods will be destroyed and the ear-heads developing during April and May will be saved. Another point about seedling selection is that it is possible to weed at the same time and in

* The main brood was however late owing to the delay in the bursting of the N-E. monsoon.

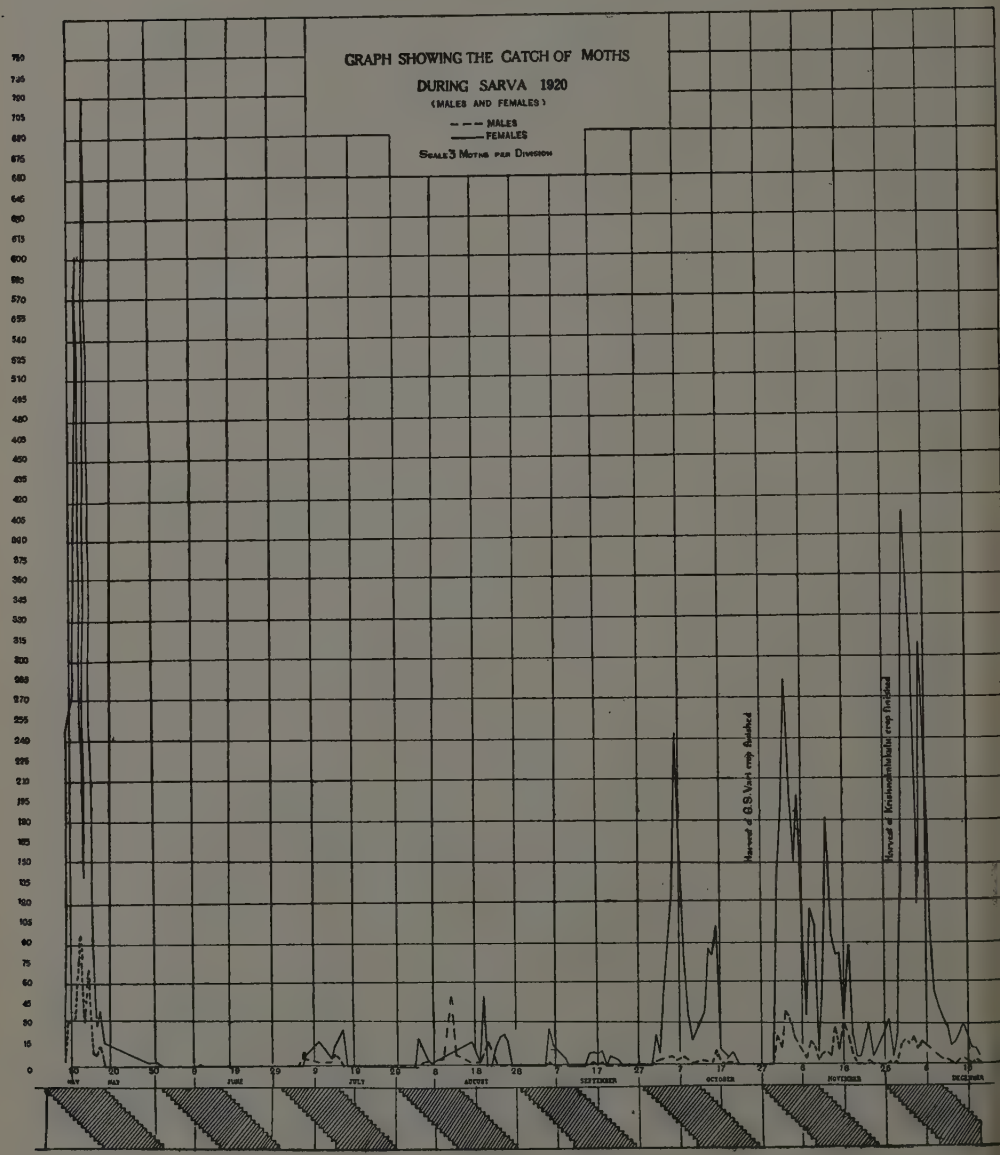
GRAPH SHOWING THE CATCH OF MOTHS
DURING SARVA 1920
(MALES AND FEMALES)
MALES
FEMALES
SCALE 3 MOTHS PER DIVISION
Harvest of G.S. Vairi crop finished
Harvest of Krishnambhatta crop finished
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

FIG. II.

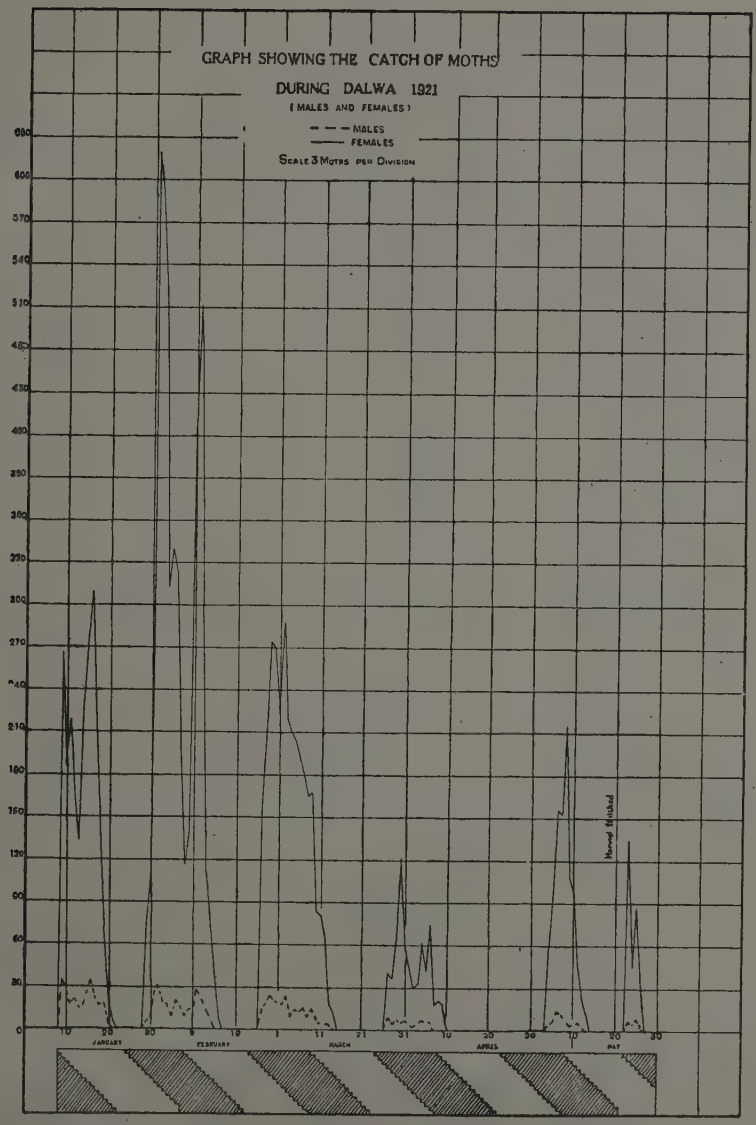

FIG. III.

this way one weeding should be saved. The cost of this weeding thus avoided should be set against the cost of the control measures. Once the crop is

transplanted and growing, it is not possible to collect damaged ear-heads or egg-masses and it has to be left alone.

V. Proportion of spent to gravid females caught.

Figs. IV and V give the proportion of spent to gravid moths caught throughout the year 1920-21. The Table shows that quite a high percentage of moths have laid their eggs before being attracted to the light.

TABLE III.

Date	Gravid moths	Spent moths	Percentage of spent to caught
October 1920 ..	600	350	36·8
November 1920 ..	1,159	702	30·5
January 1921 ..	2,285	787	25·6
February 1921 ..	3,311	1,522	31·7
March 1921 ..	1,662	799	32·4
April 1921 ..	157	172	52·2
May 1921 ..	765	499	39·4

Out of 13,640 female moths caught in these months, that is, while the two main broods are flying, 35·5 per cent. had already laid their eggs before being caught.

Time when moths fly.

Observations were made for a week at different times of the night with a view to finding the time when most moths come to the light. No moths were ever caught after 11 p.m. The number of moths caught was noted at 7 p.m., 9 p.m., 11 p.m., and 11 p.m. to 6 a.m.

The catches are given below :—

TABLE IV.

Date.	7 p. m.			9 p. m.			11 p. m. to 6 a. m.	Total between 7 p. m. & 11 p. m.		
	♂	♀ g	♀ s	♂	♀ g	♀ s		♂	♀ g	♀ s
1-II-21 ..	14	251	164	17	147	28	nil	31	398	192
2-II-21 ..	11	286	79	7	28	37	nil	18	314	116
3-II-21 ..	19	194	71	2	35	23	nil	21	229	94
4-II-21 ..	19	117	38	4	41	23	nil	23	158	61
5-II-21 ..	9	98	44	..	51	19	nil	9	149	63
6-II-21 ..	11	88	53	2	26	25	nil	13	114	78

♀g = Gravid female moths.
♀s = Spent female moths.

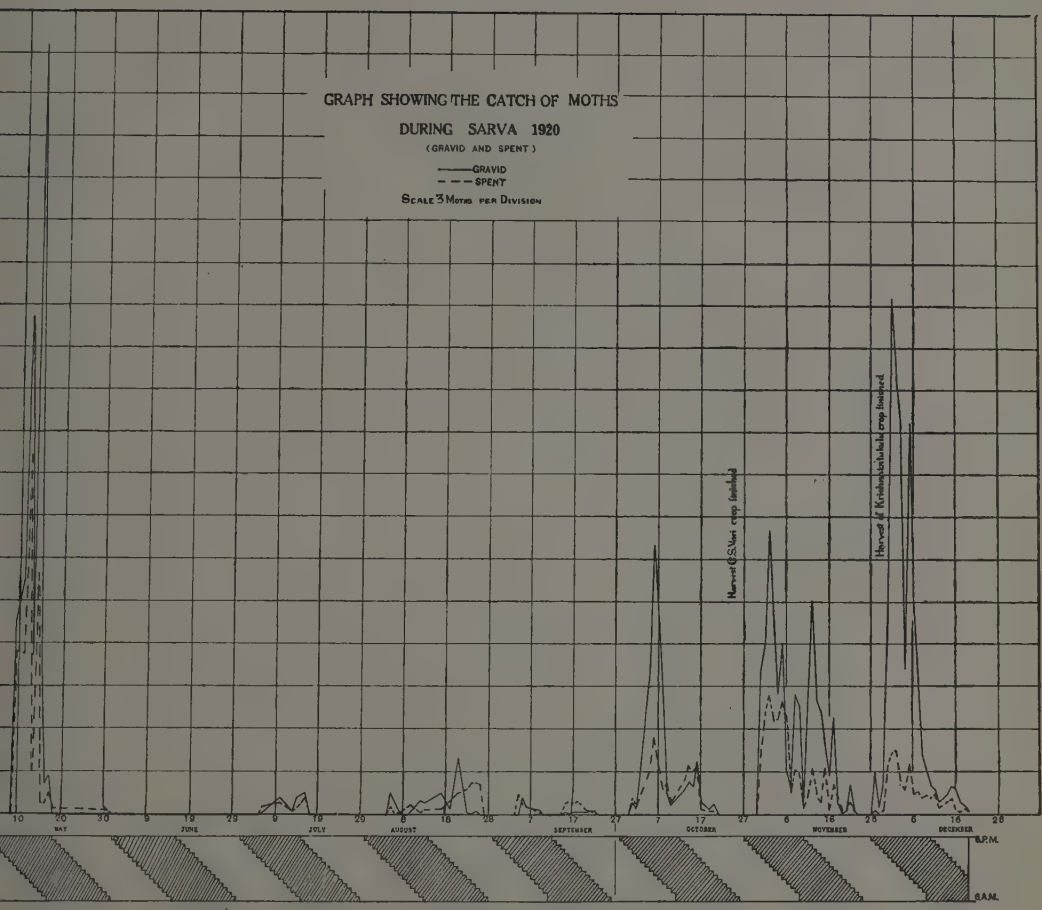
GRAPH SHOWING THE CATCH OF MOTHS
DURING SARVA 1920
(GRAVID AND SPENT)
GRAVID
SPENT
SCALE 3 MOTHS PER DIVISION
Harvest of Kolabagiri kharif crop finished
10 20 30 9 19 29 9 19 29 8 18 28 7 17 27 7 17 27 6 16 26 5 16 26
MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER
6 P.M.
6 A.M.

FIG. IV.

TABLE V.

3rd to 6th March 1921.

Date	7 p. m. to 9 p. m.			9 p. m.		11 p. m.	11 p. m. to 3 a. m.
	♂	♀	♀	♂	♀g	♀s	
3–III–21	19	117	38	4	41	23	
4–III–21	9	98	44	..	51	19	nil
6–III–21	11	88	53	2	26	25	

♀g = Gravid female moths
♀s = Spent female moths.

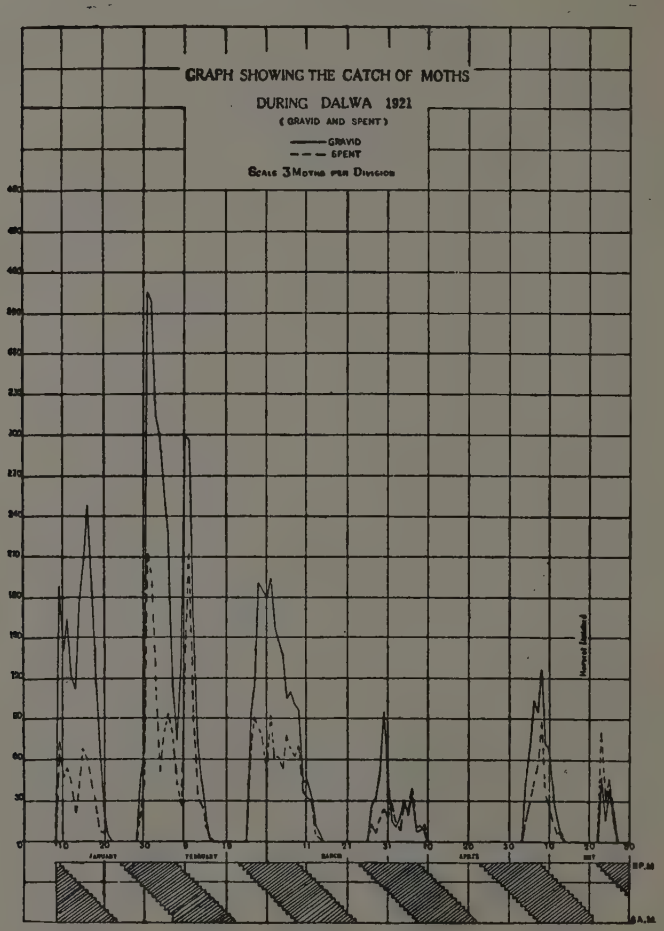

FIG. V.

VI. Close cutting and other remedies.

The idea of close cutting at the time of harvest is to prevent pupæ or larvæ which may be in the stubble from developing and giving rise to moths. It is proposed to advise close cutting in conjunction with seedling selection. By the combination of these two a very large proportion of the early generation and the last generation should be destroyed. At the time of gathering the

Sarva crop the season is generally rainy and *raiyats* are anxious to get the harvest through as quickly as possible and for this reason and from the additional labour involved close cutting is not popular. The usual practice is to leave the stubble long so that sheaves left to dry are protected from the water which is usually standing in the fields at this time of the year. It was suggested therefore that sheaves should be dried either on the *bunds* or on the drier fields. If preparation of the land for the second crop is then begun and the stubble ploughed in, any pupæ left ought to be destroyed. Burning the stubble after the second crop might be practicable.

As the fields at this time of the year (May) are dry and there is no ratooning it ought to be easy to get the fire going. As experiments at Podalada were given up with the *Dalwa* crop 1921, burning stubble was not tried on a large scale. It is not therefore certain to what extent it would be possible. Probably it will be best to cut the crop close for the *Sarva* crop and leave the stubble long for the *Dalwa* crop to facilitate the operation of burning it off. Burning stubble in this way should also destroy a certain number of moths which may be hiding in it and more again might be attracted to the fires at night.

Degree of infestation of different varieties.

One of the lines of research which it was intended to follow at Podalada was to compare amount of attack in different strains of paddy. As only two kinds were grown at Podalada, a short and a long duration variety, no comparison of this kind could be made. This work is now being followed up at Samalkota where a number of different races of paddy are being grown on the Government Farm. The difference of infestation between the two varieties grown at Podalada was due chiefly to the time of the year at which they were harvested, the long duration variety having two months more in which to become infected.

Other food plants.

No food plants other than paddy have yet been found which would assist *Schœnobius* to carry over the season when no paddy is being grown.

Natural enemies.

A Chalcid parasite has been bred from the egg-masses but is not yet identified nor has the degree of parasitism been ascertained.

VII. Measurements of larvæ at different times.

Attacked plants were periodically pulled from fields and examined for larvæ. These larvæ were measured and classed under three heads. Those

under 10 mm. in length, those over 10 mm., and those over 15 mm. This served to give further information as to when a fresh brood hatched out or another might be expected. The larval life lasts from 25–27 days and the pupal period about 7 days.

TABLE VI.

Sarva crop 1920.

Date		No. of plants examined	—10 mm.	+ 10 mm.	+ 15 mm.	Pupæ
Seedlings ..	3–VII–20	500	168	..	..	..
	10–VII–20	500	48	139	..	..
	17–VII–20	500	..	23	73	..
	24–VII–20	500	91	..	..	..
	31–VII–20	300	48	7	..	..
	2–XI–20	100	49	13	..	..
	10–XI–20	200	37	77	..	..
	18–XI–20	200	21	98	..	..
	26–XI–20	200	19	33	53	..
	1–XII–20	200	..	24	117*	..

* Crop all harvested by end of the year.

TABLE VII.

Dalwa crop 1921.

Date		No. of plants examined	—10 mm.	+10 mm.	+15 mm.	Pupæ
Seedlings ..	30–I–21	500	241	..	..	..
	5–II–21	500	149	17	..	..
	2–IV–21	200	14	104	28	..
	10–IV–21	200	..	84	49	..
	18–IV–21	200	..	18	97	..
	26–IV–21	200	51	97	14	..
	4–V–21	200	23	78	8	3
	*12–V–21	200	34	69	19	..

* Harvest.

It will be seen that at the time of transplanting the majority of the larvæ found were still not nearly ready for pupation. 48·2 per cent. and 29·8 per cent. of the 500 dead-hearts examined each week during transplanting still contained larvæ during the *Dalwa* crop transplanting season, during the *Sarva* crop 33·6 per cent., 37·5 per cent., 20 per cent., 18·2 per cent., and 18·3 per cent. It does not follow that the remainder of the seedlings had all been damaged by *Schœnobius* and the moths had emerged. Had that been the case, far more pupæ would have been found. It does however give some indication that quite a high percentage of potential moths are destroyed by the process of seedling selection. 50–70 per cent. of the dead-hearts examined at about the time of harvest for both crops contained larvæ so that by close cutting a number of these must have been destroyed by being dried up in the cut stalks. Left in long stubble in damp fields, they would develop into moths and be ready to infect the succeeding crop.

The larval life is about 3 weeks to a month. The following are a series of observations made in August and September 1920. Egg-masses were collected from the field and hatched on 8th August, 1920. The young larvæ were put out to pot-grown paddy plants and these plants were pulled up at intervals.

TABLE VIII.

Date	Length of larvæ
	mm.
2–IX–20	8
10–IX–20	10
14–IX–20	15
22–IX–20	18
20–IX–20	20
27–IX–20	20

The + 10 mm. larvæ in the above table were then about a fortnight old. In plants which have set their ear-heads and one attacked by *Schœnobius* the larvæ are found either at the last internode or the one just below it. This further strengthens the case for close cutting. When young plants are attacked the larva is found near the root.

VIII. Experiments with coloured lights.

Some experiments were made with coloured lights to see whether *Schœnobius* preferred any colour to the ordinary white light. The lamp globes were covered with coloured paper. The results were negative and are given below for what they are worth.

TABLE IX.

		♂	♀
7–VIII–20	Plain ..	..	4
	Red ..	nil	..
	Green ..	nil	..
9–VIII–20	Plain ..	6	10
	Red ..	..	1
	Green ..	..	1
12–VIII–20	Plain ..	50	12
	Red ..	8	..
	Green ..	2	..
13–VIII–20	Plain ..	8	12
	Red ..	33	8
	Green ..	7	5
15–VIII–20	No catches at any light.		

Further research is needed on the following points apart from checking all the work at Podalada.

(1) Wild food-plants of *Schœnobius*.

(2) Degree of parasitism.

(3) Possibility of immune varieties of paddy.

(4) Extent to which the stubble helps the insect to tide over the time between the crops.

IX. Conclusions.

(1) The method of selecting attacked seedlings at the time of transplanting gives some hope of constituting an effectual control of *Schœnobius*.

(2) Close cutting used in combination with seedling selection should also destroy a large proportion of the larvæ from which the succeeding crop could be infected.

(3) Burning stubble was not found to be practicable but should be tried again.

(4) Figures are given showing (1) infestation in plots selected for estimation of attack in whole area for different seasons. (2) Number of broods of *Schœnobius* in the year. (3) Proportion of spent to gravid moths caught.

(5) It is very doubtful whether light traps would be of much use as a control for *Schœnobius*. Results of a few experiments with coloured lights were negative.

Literature consulted.

LEFROY, H. M. "Indian Insect Life."

FLETCHER, T. BAINBRIGGE. "Some South Indian Insects."

"Proceedings of the III Entomological Meeting," Pusa, 1919.

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NOTE ON IDENTIFICATION OF SIGA INCERTELLUS, WLK.

The moth dealt with by Mr. Ballard in this paper is one of those unfortunate insects to which so many names have been applied that it is difficult, without extensive incursions into literature, to ascertain its correct synonymy. Owing to the differing appearance of the two sexes and to the wide distribution of the species, a double set of names has been bestowed on the male and on the female.

The earliest name appears to be *incertellus* (originally published as *incertulas* by error of MS. or printing, but corrected to *incertellus* in the Index) under which name Francis Walker described the male from Sarawak in April 1863, and at the same time, but on a later page of the same volume, he also described the same sex from Ceylon under the name *admotella*. In July of the same year, but later than Walker's Catalogue Vol. XXVII which was issued on 18th April 1863, appeared Zeller's Monograph of the Chilonidæ and Crambidæ in which (p. 4) the female was described from near Calcutta and from Java under the name *Schœnobius punctellus* and the male (pp. 5–6) from the same localities under the name *S. minutellus*. Later in the same year (but after 19th October 1863, the date of its Preface) was published Vol. XXVIII of Walker's Catalogue, in which (p. 523) this author described the female from Sarawak under the name *Tipanœa bipunctifera*. Yet another name was added by the same author in 1864, in Vol. XXX of the Catalogue, when Walker again described (pp. 967–968) the female from Borneo, China, and Colombo, under the name *Chilo gratiosellus*. Within two years therefore this species received no less than six names.

Considering that this moth is one of the commonest of insects in Southern India and is attracted to light freely, it is remarkable that it does not appear to have been named before Walker's time. In the last three decades of the eighteenth century several hundreds of insects from Southern India were described by J. C. Fabricius in various publications and in this connection I have been over the descriptions of Pyralidæ contained in his *Entomologia Systematica* (1794, 1798) without being able to find any description which can be applied with certainty to this species. It is quite likely that some name, anterior to Walker's, will turn up, but until then we must use *incertellus* as the specific name.

The generic name of this insect has also undergone several changes. For many years the name used has been *Schœnobius*, but recently Sir George Hampson (*A. M. N. H.* (9) IV, 307 ; 1919) has stated that this is ante-dated

by *Siga*, which was described by Hübner in his *Verzeichniss bekannte Schmetterlinge* (p. 197 ; 1822) for *liris*, Cramer, 63 F. and 262 E. Cramer's work is not accessible here and I am unable to trace *liris* further ; it is presumably an exotic species, as it is not included in Staudinger-Rebel's Catalogue of Palæarctic Lepidoptera (1901). The names *Catagela*, *Panalipa* and *Microschœnis* are also synonymous with *Siga* and *Schœnobius*.

The principal synonyms and references for this insect are as follows :—

SIGA, HÜBNER (1822).

Siga, Hb., Verz., p. 197 (1822). Type : *liris*, Cram. Hmpsn., A. M. N. H. (9) IV, 307 (1919).

Schœnobius, Dup., Cat. Lep. Eur. p. 312 (1844). Type : *gigantellus*, Schiff. [Europe.] Hmpsn., F. I. Moths IV, 47 (1896).

Catagela, Wlk., Cat. XXVII, 191 (1863). Type : *adjurella*, Wlk. [Ceylon.]

Panalipa, Moore, Lep. Ceylon III, 386-387 (1886). Type : *immeritalis*, Wlk [Oriental Region.]

Microschœnis, Meyr., T. E. S. 1887, 270 (September 1887). Type : *immeritalis*, Wlk.

INCERTELLUS, WALKER (1863).

Chilo incertulas [laps. cal. aut typogr. pro *incertello*], Wlk., Cat. XXVII, 143 (April 1863). ♂ [Sarawak.]

Catagela ? admotella, Wlk., Cat. XXVII, 192, (April 1863). ♂ [Ceylon.]

Schœnobius punctellus, Zell., Mon. Chil. Cramb. p. 4 (July 1863). ♀ [near Calcutta ; Java.]

Schœnobius minutellus, Zell., Mon. Chil. Cramb. pp. 5-6 (July 1863). ♂ [near Calcutta ; Java.]

Tipanœa bipunctifera, Wlk., Cat. XXVIII, 523 (post September 1863). ♀ [Sarawak.]

Chilo gratiosellus, Wlk., Cat. XXX, 967-968 (1864). ♀ [Borneo ; China ; Colombo.]

Schœnobius bipunctifera, Moore, Lep. Ceylon III, 385, t. 184 f. 13 (1886). ♀ [Ceylon.]

Catagela admotella, Moore, Lep. Ceylon III, 386 (1886). ♂ [Ceylon.]

Schœnobius bipunctiferus, Hmpsn., P. Z. S. 1895, 915, f. 19. (December 1895). ♀ [Oriental Region.]

Schœnobius incertulas, Hmpsn., P. Z. S. 1895, 916. (December 1895). ♂ [Oriental Region.]

Schœnobius bipunctifer, Hmpsn., F. I. Moths, IV, 48, f. 32 (1896). ♀ [China ; Formosa ; throughout India ; Ceylon ; Burma ; Sumatra ; Java ; Borneo.]

Schœnobius incertellus, Hmpsn., F. I. Moths, IV, 48-49, (1896). ♂ [Nagas ; Calcutta ; Ceylon ; Rangoon ; Java ; Borneo.]

Schœnobius bipunctifer, Hering, Stett. Ent. Zeit. LXIV, 74-75 (1903). [Synonymy.]

Schœnobius bipunctifer, Lefroy, Ind. Ins. Life, p. 512 (1909).

„ „ Poulton, Proc. Ent. Soc. Lond. 1909 38-39, (1909). [Captured at sea.]

Schœnobius incertulas, Poulton, Proc. Ent. Soc. Lond. 1909, 38-39. [Captured at sea.]

Schœnobius bipunctifer, Shiraki, Ins. Pests Formosa, t. 5 (1910 ?). [Life-history figured.]

Schœnobius bipunctifer, Fletcher, S. Ind. Ins., pp. 426-427, t. 29, (1914). [Very serious pest of rice throughout S. India. Life-history figured.]

Schœnobius incertellus, Shiraki, Paddy Borer. [Taihoku Agric. Expt. Stn. Pbln.] (1917). [Important Monograph.]

Schœnobius bipunctifer, Fletcher a. o., Proc. Second Entl. Meeting, pp. 171-174 (December 1917). [Distribution ; damage ; control.]

Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1917-18, pp. 86-87 (1918).

Schœnobius bipunctifer, Strand, Stett. Ent. Zeit. LXXIX, 262-263 (1919). [Formosa.]

Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1918-19, p. 88 (1919).

Schœnobius bipunctifer (*incertellus*), Dammermann, Landbouwdierkunde van Oost-Indie, pp. 59-60, t. 7 ff. 5*a b* (1919).

Schœnobius bipunctifer, Fletcher, Ann. Rept. Impl. Entom. 1919-20, pp. 69-71 (1920).

Schœnobius bipunctifer, Fletcher, Proc. Third Entl. Meeting, I, 121 (November 1920).

Schœnobius bipunctifer, Shroff, Proc. Third Entl. Meeting, I, 342 (November 1920).

Schœnobius bipunctifer, Fletcher and Ghosh, Proc. Third Entl. Meeting, I, 383, 410, t. 42 f. 3, t. 43, (November 1920).

Schœnobius bipunctifer, Ballard, Proc. Fourth Entl. Meeting, p. 22-23, 146 (December 1921).

Schœnobius bipunctifer, Ramakrishna Ayyar, Proc. Fourth Entl. Meeting, pp. 35-36, 52 (December 1921).

Schœnobius bipunctifer, Ghosh, Proc. Fourth Entl. Meeting, pp. 134, 135 (December 1921).

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